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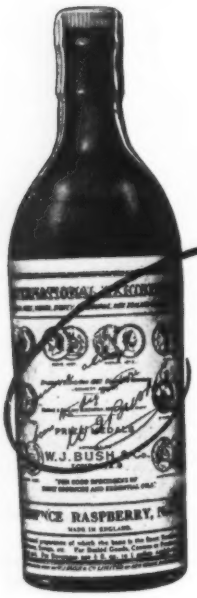

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A JOURNAL DEVOTED TO THE PRODUCTION AND MANUFACTURE OF ALL EDIBLE COMMODITIES INVOLVING A PROCESS OF MANUFACTURE.

FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

VOLUME . . . XV

NUMBER . . . 6

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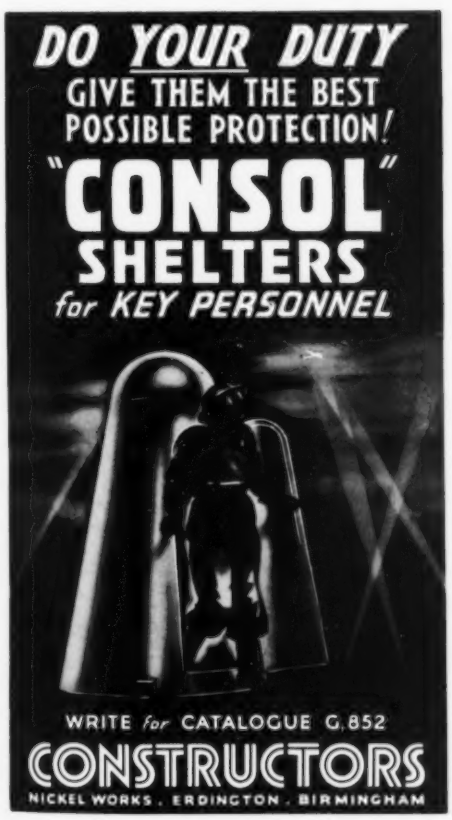
Colours and Flavours Number



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Facing first page of Editorial

FOOD MANUFACTURE

Vol. XV, No. 6 June 1, 1940

Multum in Parvo

IN COMMON with all publications, we are now definitely obliged to reduce the number of pages in FOOD MANUFACTURE. With the conviction that food technology is a vital item in the country's life and in its defence in these critical times, we have taken the step of reducing the size of our print throughout the Journal and by so doing we shall be enabled to publish the same number as before of original technical articles relating to food production, written by well-known experts on their different subjects, as well as retaining all other features. In other words, it will be possible to present in 24 pages what has hitherto occupied 32 pages. The complete change-over will be effected as soon as possible, and, as will be seen, a start has been made in this issue.

Composition of Foods

The results of a systematised analytical procedure applied to almost all foods commonly eaten in this country are tabulated in a Report (Special Report Series, No. 235) by Drs. R. A. McCance and E. M. Widdowson. All the important organic and mineral constituents of foods have been determined, with the exception of the vitamins, which have been extensively investigated by other workers. The method of approach has been somewhat different from that of previous workers in the same field, as the foods have been analysed, not only in the raw state, but also as prepared for the table, and studies have been made of the losses introduced by cooking, and there are tables showing the "available" phosphorus and iron. A mere casual perusal of the 150 pages of this valuable handbook for workers in nutrition and others will demonstrate the technically exacting and laborious and perhaps somewhat thankless nature of this type of research, which appeals to relatively few investigators, but for the results of which those concerned will be truly grateful.

Deceptive Packaging

We, in this country, are not particularly concerned at the present time with the repercussions of the interpretation and enforcement of the Food, Drug and Cosmetic Act of the U.S.A. However, it is instructive and at times useful to cast an eye upon other people's troubles.

In an address before the Tenth Packaging Conference, New York City at the end of March, Dr. Wharton, of the Food and Drug Administration, explained some of the details of deceptive packages, the chief reasons for which, on the part of the manufacturer, were: the desire to achieve artistic designs; filling and packing difficulties; packaging economy factors, such as use of same size container to pack same weights of various commodities of different densities; the changing with fluctuations in cost of raw materials of put-in weights without changing the size of the package, or retail price; and deliberate intention to mislead and defraud. One example given is one sometimes seen here—boxes of chocolates so packed as to pyramid the contents downward, each successive layer containing fewer pieces until finally, at the bottom of the package, the entire contents rest on a few pieces. Despite the fact that the weight of net contents is required to be printed conspicuously on the wrapper, the American manufacturer must realise that declaration of quantity, no matter how conspicuous, will not correct a deceptive package.

Preservation of Fillets of Fish

Reference was made in FOOD MANUFACTURE, December, 1939, to the work of Tarr and Sunderland in connection with the use of sodium nitrite ice for improving the keeping quality of fish.

In Progress Report No. 43, Fisheries Research Board of Canada, H. L. A. Tarr reports further work, in which treatment of fish with lactic acid and also sodium nitrite was examined. The treatment consisted of immersing fresh or frozen fillets of flounder and halibut in (i) a solution of 1·8 per cent. lactic acid at approximately 35° F. for 1 to 1½ hours, and (ii) a 15 per cent. (by volume) sodium chloride brine containing 0·1 to 0·2 per cent. sodium nitrite.

The results show that both the treatment in lactic acid and in nitrite brine cause a greater improvement in the keeping quality of the fillets than does simple treatment in sodium chloride brine. On the whole, it appears that the acid treatment extends the keeping quality of fillets more than does the nitrite-brine method, but it possesses the disadvantage that it produces somewhat undesirable physical changes in the fish flesh, and experiments are now being undertaken to ascertain whether any method of overcoming these changes can be found.

Communal Meals

The exigencies of war-time are making heavy inroads into home cooking. Many women who, in normal peacetime, are content to remain at home and cook or supervise the cooking of meals are now working and, as time goes on, the numbers so engaged will increase. Moreover, it is quite likely, as the war effort expands, many of these will be working ten to twelve hours a day. They will return home too tired to cook a meal, and the likelihood is that they will buy something (or really any-

thing) at the cooked meats shop or open a tin of pork and beans. This will have a bad nutritional influence, and there arises the possibility of national and co-operative canteens where good meals can be obtained readily at all hours of the day and night. Apart from the convenience there is no doubt that catering for large numbers is much more economical than doing it for a few. According to a correspondent to the *Lancet*, a meal of stewed lamb, carrots, peas, and potatoes, prunes and custard for four people costs 3s. 3d., or 9¾d. per head. For 100 people the cost was £1 19s. 5d., or only 4¾d. per head. While such a scheme offers few attractions in peace-time, when home life is always preferable, the communal kitchen has much to recommend it in war-time, when mass production of food is almost as important as that of armaments.

Confectionery Transport

Both the Ministry of Food and the Ministry of Transport have given full approval of the emergency distribution scheme organised by the Transport Committee of the Manufacturing Confectioners' Alliance. To meet the requests of the Government for a reduction in petrol consumption, the manufacturers decided that much could be done if local deliveries were pooled, overlapping of services minimised by co-operation and long-distance road transport reduced as far as possible. Those larger manufacturers who had already established rail-head depôts throughout the country to which goods were sent in bulk by rail, at the outbreak of war pooled such facilities and placed them at the disposal of the trade. There are now forty of these distributing depôts available to any member of the Alliance and at each depôt there is a fleet of pooled vans. A double saving is thus effected. More goods previously road-borne go now from factory to depôt in full rail loads. Thus vans are delivering on one journey the products of several manufacturers. This pooling system has released a large number of vehicles for Government purposes, in addition to the saving of petrol.

We suggest that such co-operation could well be continued after the war, to the advantage, incidentally, of the consumer.

Eggs

"Take a dozen eggs", said Mrs. Beeton, and this is an index of the importance of eggs in our nutritional economy. Every household uses them, eats them, and even drinks them. They have also played their parts on the music-hall stage, the films, and even Rectorial Elections. The latest tribute to the egg was a solemn and critical examination by the Nutritional Panel of the Food Group of the Society of Chemical Industry. From these deliberations we learn that, while the eggs of the octopus, the newt and the frog look after their own nutrition, the bird's egg is a type of closed box structure, which requires many ingenious devices in order to survive. The egg contains, in the smallest compass, the best materials for growth. The four proteins of egg white contain all the essential amino acids and are of high biological value. The same applies to the two yolk proteins. In addition, the egg contains iron, calcium, phosphorus and copper and vitamins A, B_1, B_2 and D. Apart from vitamin C, the egg has all the protective material essential to human existence. Another important point raised was that its proteins supplement the proteins of cereals—so what better food than a poached egg on toast! The egg is a costly food, particularly in war-time, but a good one, and if suitable storage methods could be applied when eggs are plentiful great advantages would accrue. In this connection Dr. Lampitt, in his Cantor Lectures, recently said that science has proved that eggs, properly frozen, are more hygienic than eggs in shell, so there is something in the Chinese egg after all.

Air-Conditioning Benefits

The opinions of doctors on air conditioning gleaned by a nation-wide survey in the U.S.A. were recently described in *Medical Economics*.

Although the data collated was concerned with doctors' consulting rooms and with treatment of patients with specific complaints such as asthma, hay fever, sinus conditions, etc., it is suggestive when considered from the point of view of food factory work. It may have already been done, but, if not, it would be instructive if statistics were prepared showing the difference in resistance to disease and in general efficiency during work between sets of workpeople doing similar jobs, in air-conditioned and non-air-conditioned factory departments.

Protective Films on Tinplate

A simple and inexpensive process has now been evolved in the International Tin Research and Development Council's laboratories which produces an oxide film on tinplate giving it such protection as has until recently been obtainable only by the use of special lacquers. The process tends to avoid the formation of unsightly black stains when certain types of vegetables, meat and fish products are packed in cans. In the case of vegetables, the colour of the product may be affected. The film, as now developed, although so thin as to be invisible, has been found to afford good protection from sulphur staining and to prevent bleaching of the contents with many canned vegetables. It has also been found effective with meat products and soups, and preliminary tests with fish are promising. Tests with fruits, however, have given poor results, as the film appears to be slowly dissolved by the citric acid present. Further experimental work is being carried out by the Council in collaboration with other organisations, leading canners, can-making firms and tinplate manufacturers.

Compulsory Milk Pasteurisation

A recent question in the House received an answer from the Minister of Health which disposed of any hope of early legislation on the pasteurisation of milk. Apart from already existing arguments in favour of pasteurisation, Mr. David Adams suggested that owing to the additional duties imposed upon local authorities due to war conditions, there was a danger that the supervision of milk supplies and the matter of inspection of farm premises, storage and handling of milk and the collecting and testing of samples might be relaxed. Mr. Adams also asked the Minister whether he was aware that non-designated milk is not only dirty, but tubercular. There was no reply.

We cannot view the possibility of any relaxation in control of such an important food as milk with anything but incredulity, and control should be tightened up rather than relaxed. After all, health on the home front is an important item of defence.

The Phosphatase Test

This test has disposed of one of the chief planks of those opponents of milk pasteurisation who claim that, while pasteurisation is effective in theory, it is often ineffective in practice and that consequently the security it gives is limited. The quantitative test devised by Kay and his colleagues at Reading can be used to assess the efficiency of "holder" pasteurisation. The test has not yet been blessed by official recognition. Only the holder method of pasteurisation is recognised officially, with specified limits of temperature and holding time, but much experimental work has been done in this country and the U.S.A. on a different set of conditions mostly of the "high temperature short time" variety. The experimental work is, on the whole, satisfactory, so it is important to assess the value of the phosphatase test for this type of pasteurisation. A booklet issued by Kay and his colleagues sets out the technique and utility of the test, and sums up the position by stating that for these variations experience is still limited, "but there can be no doubt that, possibly with minor modifications, it will provide as sensitive and searching a method of control here as it has already provided for 'holder' pasteurisation". It seems to us sufficient evidence has now been gathered to justify the phosphatase test as an official one for pasteurised milk as defined by the Ministry of Health.

Industrial Dermatitis

Recently the Royal College of Surgeons presented evidence on industrial disease before the Royal Commission on Workmen's Compensation, and concern was expressed at the steadily increasing incidence of industrial dermatitis in the industries that have to do with the handling of flours and liquids. The College maintained that dermatitis was an ill-defined disease, as it apparently included all sorts of skin diseases caused by any sort of dirt or any kind of liquid. The opinion was strongly expressed that "prevention should be more closely linked up with compensation as a means of emphasising the occurrence of disabilities which are compensable, but not prevented by the present regulations, such as dermatitis, and thereby enabling further preventive measures to be instituted at an earlier stage than is at present possible". It was advised that, in the case of industrial dermatitis, a second attack should require a change of occupation. There is certainly much to be said for this suggestion, as dermatitis seems to be a personal idiosyncrasy, and with some the disability becomes wholly or predominantly psycho-neurotic, and, in such case, no amount of treatment can be really effective.

That Colour Problem

War-time food problems have revived the hoary white and brown bread controversy. One side calls attention to the deprivation of the people of vitamin B_1 and mineral salts and the other to the inclusion, with these useful elements which may be provided in other foods, of some 10 per cent. indigestible cellulose.

A leading article in the *Lancet* of April 27 sets out the problem with commendable calmness. An article appearing in a leading medical journal, written specially for medical men, merits the attention of the layman. Rightly or wrongly, it declares that "one of the oddest things is that no protagonist in the fight appears to have considered what exactly is meant by brown bread and of what ordinary baker's bread is made". Is it possible that all the ink spilt and all the excitement engendered over this question is largely neutralised because both sides have been arguing about different things?

It is pointed out that "brown bread may be almost anything from germ bread to a bread made from a white flour to which a proportion of wholemeal flour, bran, or (in the North of England) rye flour has been added". In buying bread you can be pretty certain of what you are getting if you buy white bread, germ bread or wholemeal bread, but not if you buy "brown" bread.

Some Pros and Cons

The article goes on to say that wholemeal, so-called, encourages weevils and grows rancid on storing, whereas white flour does not. After stating that neither wholemeal nor white flour are good foods in themselves (surely nobody ever suggested that they were!), it is said that, except in respect of iron, it is not true that wholemeal bread is so much superior to white bread. Further disadvantages of wholemeal are that it contains little calcium, its calcium to phosphorus ration is 1:7, whereas the ratio should be 1:1 or 1:2, and it contains phytates, which conduce to rickets.

"Its deficiencies must be made good by extra milk and cheese and possibly a good source of vitamin D such as cod liver oil. Of course, wholemeal contains roughage, whereas white flour does not, and some have held that this is the reason for preferring wholemeal bread to white. But not everybody needs roughage in the diet. In fact, to some it is a thing to be avoided, and were the Government to insist on an 80 to 90 per cent. extraction of the berry, as it did in the last war, the coarseness of the bread would again cause alimentary disturbances."

The writer is satisfied that "the dietetic gain from a thorough extraction is by no means so great as is often maintained", but continues "that the Ministry (of Food) may allow commercial interest to predominate over human dietetic merits and maintain the *status quo* in the milling world".

The Truck Act Again

In our April issue we referred to the recent decision of the House of Lords in the case of Pratt *v.* Cook. Since then Sir John Anderson has made a further statement and interpreted the decision as meaning that in certain classes of case an employer may not contract to remunerate a workman, for example, with £3 a week, plus meals, valued at, say, 10s., even where he could legally have contracted to pay £3 10s. less 10s. for meals supplied, and that where a contract has been in the form now declared to be illegal claims can be made for the recovery of remuneration not paid in cash over a period of 20 years past. The result is that a number of workpeople in various employments can legally claim to be remunerated twice over. In future any contracts must be in a form which complies with the provisions of the Truck Act as now interpreted by the House of Lords, and it is not proposed to amend those provisions, but the Government deem it necessary and proper to legislate for the purpose of preventing claims as regards the past which have no merits and would, if pursued, tend to disturb good relations between employers and employed. They are about to introduce a Bill to bar claims for the payment in cash of remuneration which was provided in the form of food, and the Bill will provide for the discharge of proceedings which have already been started, but judgments given or settlements reached up to date will not be interfered with.

Alpha and Omega

How the new apple juice industry was started at DARTINGTON HALL. This article describes modest beginnings, difficulties surmounted and final emergence to operations on a commercial scale.

THE BIRTH OF AN INDUSTRY

H. T. FAWNS, M.Sc., A.I.C.

AMONG OTHER activities, an important function of this pioneer enterprise is the establishment of rural industries connected with agriculture. The experiment was started in 1925, when Mr. and Mrs. L. K. Elmhurst took over the ancient Dartington Hall Estate, two miles from Totnes, and set out to organise it on its present basis. It was essentially a large-scale experiment in commercial agriculture and estate management, and the first outcome was the establishment in 1929 of Dartington Hall, Ltd., whereby the whole industrial undertaking was centralised and the component parts administered by department heads answerable to a managing director. As an experiment it is interesting in itself as showing how individual farmers might benefit themselves, their lands and their employees by combining together to form commercial agricultural companies or co-operative societies. In the case of Dartington Hall, Ltd., which is a private company, the shares are owned by the Dartington Hall Trustees, who have agreed to apply any trading profits to the furtherance of the undertaking as a whole.

Apple Juice

When the production of fresh, unfermented fruit juices, particularly apple juice, assumed such large proportions on the Continent—notably in Germany and Switzerland—owing to recent technical improvements in manufacturing methods, Dartington Hall, Ltd., became interested in the subject too and saw here a further outlet for the estate apple crop and possibly soft fruits as well.

Up to then the ciderhouse had concentrated on the production of high-grade bottled ciders. It was found, however, that there was only a limited market available for the product of a comparatively small-scale plant, and the idea of introducing an entirely new apple beverage appealed to those concerned as offering additional scope for the factory. Also, the introduction to England of such an intrinsically good fruit product was judged to be in keeping with the spirit and ideals of the Dartington Hall enterprise. Joint experimental work by the ciderhouse staff and laboratory was therefore undertaken, which had its beginnings about 1934, and considerable help was obtained from Long Ashton Research Station, Bristol, where Mr. V. L. S. Charley's well-known work in this field was already in progress.

It was only fitting that Dartington Hall as a pioneer experiment in agricultural organisation should be the first place to undertake commercial apple-juice production in England, from local apples, and in 1936 the plant was laid down to carry this out. It was at that time the only plant of its kind operating in England and the product was the only home-produced, non-fermented apple juice on the market.

Preliminary Work

Much preliminary work was carried out before the plant, as it exists to-day, was installed. The early work was concerned largely with obtaining a satisfactory blend of apples.

It is now known that while the juices of certain varieties, if separately treated, are quite unsuitable owing to their relatively acid or astringent nature, the careful blending of these juices with more average samples results in a highly satisfactory product. Individual pressings of single varieties were therefore followed by the preparation of "blend" juices, as indicated by the analytical figures, until a satisfactory product was obtained.

The various batches of juice were stored in casks or hogsheads of various sizes according to the amount of juice prepared. These were rendered airtight by lining with a special enamel, having been previously sterilised with liquid SO_2 and washed out with sterile water. For the small-scale work which these initial experiments entailed this method proved satisfactory, but it was of course realised that further difficulties and problems were likely to arise when commercial production was commenced, and that the requisite equipment, as used on the Continent, would have to be installed, owing to the difficulty of maintaining a large bulk of fresh juice in a state of sterility over long periods.

The purchase of a filtering unit and other equipment enabled investigation to be made into the different technical methods available for the stabilisation of the juice. On the Continent it was found that both the "cold" (sterile filtration) and the "warm" (pasteurisation) processes had been widely and successfully adopted. The blends of local juices, previously prepared, were therefore stabilised by both methods and the results compared.

Training of Personnel

Another important point which arose during this experimental stage was that of training personnel. It is far easier to allow apple juice to ferment and become cider than to keep it sterile and unfermented over a period of months, and a staff used to preparing cider had to become accustomed to the idea of working to a

standard of sterility higher than that required in a Grade A (TT) dairy. In Germany and Switzerland there is no shortage of trained personnel as the industry runs special instruction courses and examinations for these men, who then become qualified as juice makers—*Süssmostherstellеr*. The Dartington Hall staff had to learn by experience.

Further, difficulties had to be overcome in the adaptation of old and somewhat unsuitable buildings for the processing of a highly fermentable product. Where yeasts and moulds abound there will always be a risk of infection, and unfermented apple juice, with its high sugar and nitrogen content, is naturally most susceptible. In Germany and Switzerland the modern technical methods of production are carried out in new buildings specially designed to meet the case, but the installation of the modern plant in an old building is beset with obvious difficulties. It is extremely difficult to cleanse the rough walls and old oak beams of a ciderhouse, several hundred years old, sufficiently thoroughly or frequently to prevent them acting as a source of air-borne infection. These theoretical considerations were confirmed by a series of bacteriological tests which gave marked evidence of air-borne infection. Accordingly, a small room at one end of the building was specially adapted for carrying out a pilot trial with the cold process (sterile filtration) in order to give it a reasonable test. Corresponding pasteurisation trials showed that the use of a suitable pasteurising time and temperature resulted in a product just as satisfactory as regards flavour and keeping quality as a cold-process juice. In the course of these pilot trials of juice varieties and processing methods, much was learned of the technical difficulties likely to be encountered in commercial production.

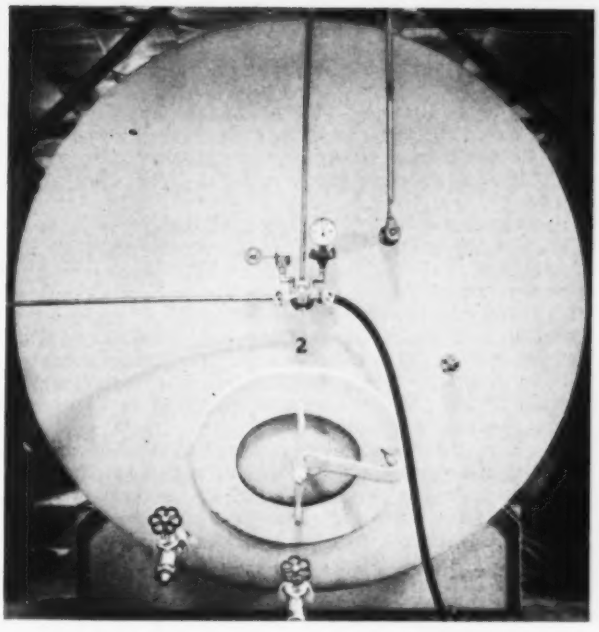
Laboratory Control

The laboratory played a considerable part in these early experiments and small-scale tests. Analyses were carried out, not only of the individual juices and blends but also of a number of continental juices, samples of which were obtained for comparison. German, Swiss, French and Austrian apple juices were compared both for taste and chemical composition with the local product. The following analyses were carried out: Specific gravity, total and volatile acid, tannin, SO_2, total and reducing sugar, alcohol (this latter should be less than 0·5 per cent. according to German and Swiss legal standards, 1 per cent. in our own Food and Drugs Act Regulations), and sometimes pectin and ascorbic acid.

Moreover, since the depth of the colour might be an important factor in winning public approval, the colour of some juices was measured on a tintometer and recorded in Lovibond Units.

While this joint work was in progress in ciderhouse and laboratory, the sales department were considering the question of a suitable pack. The German and Swiss producers were "getting it across" to their public by propounding the idea of *flüssiges Obst*—liquid fruit—and had designed a number of attractive bottle-labels and wrappers, depicting this idea. Therefore, after analysis and tasting of continental products, the empty bottles were submitted to the sales department for their consideration. In many cases, the labels were steamed off and kept for reference. The types of bottle used by the various continental producers covered a very wide range of shapes and sizes and shades of coloured glass; everything from the lordly champagne bottle with wired-in cork to the plebeian screw-topped flagon. Many of the labels showed considerable ingenuity and artistic skill and were well worth a careful study.

In due course, Dartington Hall put small batches of apple juice on the market as an addition to its "Hall Mark" and "Devon Valley" cider, and consumers' opinions were solicited regarding this new product. It received a very favourable reception. Therefore, in 1936, apple-juice production was undertaken on a larger scale, and the present plant was laid down. From then on, cider and apple juice were to live side by side on equal terms.



Front End of Pressure Tank showing Fittings.

For storage purposes it was decided to employ the system of tank storage under CO_2 pressure, invented in Switzerland and found to give such good results in continental practice. This, combined with sterile bottling or pasteurisation of the bottled juice, had already found favour abroad. Extra accommodation was provided to house the tanks by an annexe specially constructed at the side of the existing press-house. The final flavour of the bottled juice is of the utmost importance and the "bulk" storage of the apple juice (by cold process—*i.e.*, unpasteurised—under high pressure) as soon as possible after it leaves the fruit press was considered essential. The final processing can then be undertaken satisfactorily, as far as flavour is concerned, either by sterile bottling or pasteurisation in bottle, and the Dartington factory was equipped to practise either method.

Present Methods

Now that the steel storage tanks are installed, the manufacture of Dartington Hall apple juice is conducted on the following lines. The apples are washed *twice* in running water in a trough. The bad ones sink to the bottom, the good ones are skimmed off the top and placed on an elevator belt which carries them to the top of the press-house. They then pass through the crushing machine (grater type) and the mash falls through a chute on to a trolley, where it is made up in woollen cheese-cloths and the trolley run on rails to the press. This is a small hydraulic type, working at 1,500 lb. per square inch and capable of dealing with 10 cwt. of fruit at a time. From the press, the juice flows to a specially lined tank under the floor, whence it is pumped and clarified by passage through a high-speed centrifuge, capable of dealing with 120 gallons per hour at 18,000 r.p.m. This throws down not only any remaining large particles, but also some pectin and colloidal matter, together with most yeasts and mould-spores left over from the preliminary washing. From the centrifuge, the juice is pumped into the storage tanks. During this

transit, it is mixed with CO_2 from cylinders by means of an impregnating apparatus. An alternative method, found to be more economical, consists in the use of solid CO_2 placed in the empty tanks.

Once in the tanks, it can be safely stored under 8-atmospheres pressure of CO_2 for an indefinite period without fear of deterioration. As a routine measure, periodic analyses of the tank contents are made. There is no fermentation or change in the juice while under pressure.

In choosing the tanks it was decided to import one unit of 5,500 gallons capacity, complete, from a firm specialising in their production. This tank was lined with the "five-fold" enamel process and fully equipped with stainless steel fittings. Other tanks were purchased from an English firm after much consultation regarding specifications, etc., owing to their being an innovation in this country. These were lined at the engineering works with an acid-resisting material, and equipped with cocks, pressure apparatus, etc.

When required for bottling, the juice is drawn from the tanks along a pipeline to the filter and bottling unit. The CO_2 pressure in the tank can be used to force the juice from one part of a given factory building to another. The CO_2 is released and the product bottled in a practically "still" condition, a trace of the gas being left to fill the air-space above the liquid in the bottle.

Bright filtration is considered desirable, a highly "polished" juice being more stable as well as attractive to the eye.

After bottling and crown-corking, the bottles are taken to the dispatch room for labelling and packing, or temporary storage.

Apples destined for *cider* pass through the identical process of milling and pressing, the same plant being available for both, but instead of passing to tanks for pressure storage, it is pumped to the fermentation vats. An interesting point here is the use of special *yeast starters*. Normally, fermentation is carried out by the natural yeasts present on the fruit, but it has been found that a better and more uniform product is obtained by rendering the juice sterile, or nearly so, by centrifuging or filtration, and then *inoculating* with a "starter", consisting of a few gallons of juice already set in active fermentation by adding a culture of a special yeast type. It is sometimes found advisable to accelerate the fermentation of the starter by the addition of a small amount of ammonium phosphate. "Steinberg", Zeltingen" and one or two other yeasts have proved successful.

A by-product of apple juice and cider is, of course, the pomace, or residue from the press. As Dartington Hall is an agricultural concern, there is an outlet for this on the spot, the pomace being carted to the fruit farm and composted with other farm waste and manure. Approximately ½ cwt. of lime to the ton of pomace will neutralise the acidity.

Fruit Syrups

Another development at Dartington Hall is the production of fruit syrups from various bush-fruits grown by the orchards department. The chief products are black currant syrup and a mixed syrup "Four-fruit", consisting of—black currant, raspberry, loganberry and strawberry in certain proportions.

Black currant syrup is of special nutritional value by reason of its high vitamin C (ascorbic acid) content. Chemical determinations of this in the prepared syrup, using the indophenol titration method, have yielded figures as high as 80 mg. per 100 ml., considerably higher than citrous fruits. Laboratory tests at Dartington Hall recently showed that the product maintains its vitamin C content considerably longer if stored in tanks ("bulk storage") *in the dark*. Access of light causes marked diminution of ascorbic acid on standing for any length of time. More detailed storage tests are in progress and will be reported later.

The syrups are manufactured as follows:

The crushed fruit is mixed with "filtragol" or other pectolytic enzyme and allowed to stand for about 24 hours. It is then pressed and the juice centrifuged. Sugar is stirred into the juice until the specific gravity is 1·33 (approximately 67 per cent. sugar) and the product stored in a tank. It is drawn off as required, filtered through kieselguhr and bottled. It has been found that with a high gravity syrup of this kind, the use of SO_2 or other preservative is unnecessary. No heat is required for its manufacture, and the fact that it is a "cold process" syrup ensures the maximum retention of vitamin C. As with apple juice, so with syrups, a ready outlet is found for locally grown fruit.

It should be noted that no SO_2 or other chemical preservative is used in any of the Dartington Hall products. SO_2 is only used for sterilising bottles and certain pieces of apparatus more conveniently dealt with by this means than by steaming. A 2 per cent. solution has been found satisfactory in these cases.

This form of conservation of fresh fruit as juices and syrups retains the main nutritional constituents of the whole fruit and makes them available the whole year round. Besides this, it ensures the maximum use of all edible fruit, since "culls", the ungraded market fruit, can be converted to juice or syrup. It also solves the growers' difficulty of finding a profitable outlet for an unusually heavy harvest.

In Germany, where the *per capita* consumption of fruit has been restricted for some time, being largely dependant on the success of their harvest, these methods of conservation have been applied to every type of home-grown fruit obtainable—even rhubarb. In the present state of emergency the importance of work of this kind here in England cannot be over-estimated.

LIST OF SUPPLIERS TO DARTINGTON HALL

Special "Dukeron" Enamel: *Murphy and Sons, Ltd.*
Pressure Tanks: *J. Thompson (Dudley), Ltd.*
Filter Press: *S. Stowe and Sons.*
Carbon Dioxide: *Carbon Dioxide Co., Ltd.*
Centrifuge: *Sharples Centrifuges, Ltd.*
Bottling Machine: *Bennett, Sons and Shears, Ltd.*
Tintometer: *The Tintometer, Ltd.*
Apple Washing Plant: *H. Beer and Sons, Ltd.*
Bottle Washing Plant: *Thos. Hill Engineering Co., Ltd.*

Processing Staple Foods

(*Continued from page* 159)

ing, was found to be very suitable in the manufacture of plywood. From these various reports it seems to be a safe guess that, in future, starch from Canadian potatoes will be a commercial commodity of some importance.

New Types of Grain and Fruits

Research work in North America has been in the past eminently successful in the production of new types of grain, forage crops, and fruits, and in this way has stimulated the production of food. It has also aided greatly in protecting valuable crops from disease and insect ravages. Research programmes can still assist along these lines, and, by application to marketing problems, can combat the accumulation of surplus grains and farm wastes, by finding new uses for processed farm products.

SOME FUNDAMENTAL PRINCIPLES OF FOOD FLAVOURING

H. STANLEY REDGROVE, B.Sc., F.I.C.

FLAVOURS, or rather the materials to which the diverse pleasing flavours of food are due, may, like the vitamins, be described as "accessory food factors". Although these materials are devoid of any nutritional value in themselves, food which does not contain them is not appreciated, and for this reason—apart from the carminative properties of many flavouring materials—is not well digested. Ill-flavoured or insipid foodstuffs do not sell unless, of course, they are raw materials, like cereals, which the housewife or the *chef* intends making into a savoury dish by the addition of herbs, spices, or other flavouring material.

Flavour and Taste

In any consideration of the subject it is necessary to emphasise at the onset—even if this has been done often before—that flavours and tastes are distinct. Tastes are limited in number. There are probably no more than seven—namely, sweet, salt, sour, bitter, metallic, alkaline, and pungent. Flavours are, it would seem, practically unlimited. They respond much less easily than do tastes to classification, either quantitative or qualitative.

Flavours are closely allied to odours, and a fairish idea of the flavour of a material can be got by smelling it. They are not, however, identical, even if, as does appear to be the case, flavours are appreciated by the olfactory sense. This is well exemplified in the case of artificial pineapple essences. It is a fairly well-established fact that the essence having the finest odour is not necessarily that with the finest flavour.

For their full appreciation, many flavours must be accompanied by certain "appropriate" tastes. The reason for this is obscure. The appropriateness may be no more than the result of habit. Most fruits, for example, in addition to possessing characteristic flavours, are sour and sweet in varying degrees according to ripeness and the nature of the fruit.

Taste Combinations

We are accustomed to this combination, and when we eat (say) a jelly or other food vended under the name of a particular fruit, we expect to get the accustomed combination, and do not appreciate the flavour, however accurate this may be, if we do not, at the same time, taste the right degrees of sweetness and sourness.

This fact is one of great practical importance to both the manufacturer of flavouring essences and the food manufacturer who uses them, for the reason that some essences, even those made from the natural material, may lack the necessary "taste" elements, which must be added when the essences, in this case, are used.

Indeed, the demands of the public go beyond this, since an appropriate colour is also often demanded. This is commonly the "natural" colour, or a conventional exaggeration of this.

The public is very conservative in the matter of flavours. Many flavouring essences are made along lines and from raw materials similar to, or in some cases identical with, those used in the confection of perfumes—namely, by the dissolution in spirit of essential oils distilled from plants—and carbon compounds, more especially alcohols, esters, and aldehydes, synthetically manufactured. But whereas novelties—even startling ones—are appreciated in perfumes, the public does not like really new flavours. A flavour, to be popular, must closely resemble and recall a flavour to which the public is accustomed. Very few exceptions to this general statement can be adduced. Hence, work in the domain of artificial flavouring materials has been almost entirely directed to the production of materials whose flavours closely resemble those of natural foods. Outstanding examples are provided by the butter flavour, reproduced by di-acetyl; the meat flavour, reproduced by mono-sodium glutamate; the coffee flavour, of which excellent imitations have been made; and the fruit flavours. Much attention has been devoted to the latter, and in the case of a few fruits, such as apples, peaches, bananas, and American grapes, full or partial analyses of the material responsible for their flavours have been made. Esters of fatty alcohols and fatty acids, and also certain fatty aldehydes, play an important part in the production of both natural and artificial fruit flavours. In recent years very marked improvements in the latter have been effected both in this country and in Holland. The compositions of these improved products are closely guarded trade secrets.

Artificial Spice Flavours

Relatively little has been done in the way of producing artificial spice and herb flavours, mainly owing to the relative cheapness of the natural products. Exceptions are provided by vanilla, whose flavour is mainly due to vanillin; Tonka bean, whose flavour is mainly due to coumarin; and cinnamon, whose flavour is mainly due to cinnamic aldehyde. Synthetic vanillin is one of the most widely employed of artificial flavouring materials, and is often used in conjunction with fruit flavours. Synthetic coumarin and cinnamic aldehyde also find their uses.

Food may be flavoured either by the direct incorporation of the crude natural flavouring material, by means of flavouring material derived therefrom, by means of artificially prepared (synthetic) flavouring material, or by a combination of these methods.

The method actually adopted is determined by (i) the nature of the flavour, (ii) the nature of the food in which it is desired to incorporate the flavour, and (iii) by public taste, which, in certain respects at any rate, is local.

The Frenchman likes to find little black specks in his vanilla ice. It is an indication to him that the ice has actually been flavoured with vanilla. The Englishman (perhaps I should say Englishwoman) has developed a different taste, and crude vanilla is ruled out. In some parts of the country dark specks of herbs are liked in sausages. In other parts they are not liked, and appropriate essential oils or essences have to be substituted for chopped sage and other herbs.

Essential Oils

In the case of citrus fruits, such as lemons and oranges, the volatile or "essential" oil to which the flavour is due can be obtained by direct expression from the rinds of the fruits. But these cases are exceptional. Generally speaking, the essential oil is not present in sufficient amount for expression to be practicable. Hence steam-distillation is employed.

Invariably, however, steam-distillation induces some chemical changes. The effect of these changes on flavour may be slight or drastic. But, in any case, tastes due to non-volatile constituents of the natural flavouring material are lost.

This is sometimes an advantage, when the taste is not a particularly agreeable one but is unpleasantly bitter or astringent. For example, the flavour of a carefully distilled clove oil is superior to that of cloves themselves, or, rather, it seems superior because it does not carry with it the astringent taste due to the high percentage of tannin which cloves contain. On the other hand, a badly distilled clove oil has a flavour definitely inferior to that of cloves, owing to chemical changes induced in the oil by the distillation process.

Consider, on the other hand, the case of garlic. Garlic itself contains a sugar (fructose) combined with the pungent, odorous volatile oil. When garlic itself is used to flavour food, the resulting flavour is appreciated in conjunction with a slightly sweet taste. This taste is lost when garlic oil is used to replace garlic, unless a suitable sweetening agent is also added. This is highly important to the manufacturer of sausages and meat pasties, since, in this country at any rate, onions are more appreciated than is garlic, and in the onion the sweet taste is even better developed.

Fruits in general contain too little essential oil, and their essential oils are of too delicate a chemical character, to make distillation practicable. Of course, the citrus fruits provide exceptions, but the distilled oils obtained from these are very much inferior to the expressed oils.

The flavours of pure essential oils—and the same is emphatically true of synthetic flavouring materials—are overwhelmingly powerful. To be properly appreciated the materials must be savoured in a highly dilute form. Hence, the quantity of essential oil or synthetic mixture required to flavour a given weight of food is always a minute fraction of this weight. The satisfactory incorporation of a very small quantity of oil in a large mass of solid or semi-solid matter is difficult. Hence, oils and pure synthetics are usually replaced by essences, which are simply solutions of these materials in a suitable menstruum.

Solvents

Undoubtedly the best solvent for use is pure ethyl alcohol suitably diluted with water. The proportion of water present will be determined by two factors—namely, (i) the desired concentration and (ii) the solubility of the various constituents of the oil, natural or synthetic.

Certain essential oils are particularly rich in hydrocarbons—terpenes and sesqui-terpenes—which are highly insoluble in diluted spirit. For example, lemon oil consists very largely of terpenes plus about 4 per cent. of citral. From the flavour point of view the citral is very important, while the terpenes, although not flavourless, are of relatively little importance. By appropriate means oils can be largely freed from terpenes and also from sesqui-terpenes, and the oils so freed are highly valued for making flavouring essences, especially "soluble flavouring" essences used, for example, by manufacturers of soft drinks, owing to their relatively easy solubility in diluted spirit.

Essences can also be made direct from the natural flavouring material by macerating it in spirit. These essences, known as "extracted" essences, have flavours which, in general, are superior to essences made from distilled oils, because more exactly "natural". Often a combination of both methods is employed, the extracted essence being fortified by the addition of the appropriate essential oil, or, in some cases—*e.g.*, fruit flavours—by appropriate synthetic flavouring material.

In certain instances glycerin is added in small amount to fortify the solvent action of the spirit; and this represents an innocuous addition. Of course, it is only in place where a slightly sweet-tasting essence is suitable. It has been specially recommended for use in making genuine vanilla essence; but according to Kessler, although giving an extract of darker colour and heavier body, it does not aid in the reduction of the alcohol content, nor does it enhance the flavour, and he condemns its use as uneconomical.

The volatility of alcohol represents a drawback to its use as a flavouring essence menstruum in the case of essences which are to be added to food prior to strong heating—*e.g.*, boiled sweets. In this case solutions of the flavouring materials in pure mineral oil (liquid paraffin) are more suitable for use.

Other solvents have been proposed for use, but are mostly objectionable. Isopropyl alcohol is cheaper, owing to duty on the latter, than is pure ethyl alcohol. However, it is somewhat toxic, though doubtfully so in the proportions in which it would be ingested if used as a flavouring essence menstruum; but its objectionable odour and taste constitute big drawbacks to its use. The glycols, with the exception of 1,2-propylene-glycol, appear to be definitely toxic, and should not be employed for the purpose.

Food manufacturers dealing with reputable firms of essence manufacturers will experience no difficulty in getting guarantees that the essences supplied are free from isopropyl alcohol and glycols. These firms will also give useful advice as to the type of essence most suitable for a specific purpose, and the best proportion in which to employ it. The proportion need not, in general, be rigidly adhered to; but experiments with small batches of the article which it is desired to flavour with quantities of the essence near the recommended proportion will enable the manufacturer to decide which yields the most pleasing result.

Sometimes a note of distinction can be got by using two nearly related essences in conjunction. But too great originality must be avoided, as almost certainly the British public will not appreciate the result.

The Immediate Future

With respect to the present time and the immediate future, there are two matters calling for action. The war is not likely to kill the demand for various foods having fruit flavours; but these must be regarded as of secondary importance. More attention needs to be directed towards flavours of a savoury type, whereby nutritious but insipid food may be made palatable and the æsthetic quality of various imitations, which the exigencies of war may compel us to eat, may be improved. It may be questioned whether all food manufacturers are taking full advantage, in these directions, of what science has achieved and what progressive flavouring essence manufacturers have to offer. The present writer, for example, has tasted margarine (a very well-known brand) which, although free from the not-too-pleasant flavour of the early margarines, is insipid, owing to the fact that the manufacturers are not making adequate use of diacetyl. Moreover, where the meat content of sausages is at its lowest, there is really no reason why the flavour should suffer.

On the other hand, research is necessary and should be pressed forward, with a view to enlarging the number of savoury flavouring agents available. For example, it has yet to be discovered how successfully to imitate the characteristic flavour of lard. And, in general, it may be added, the array of flavouring materials available for the manufacturer of savoury foods is poor in comparison with those which the manufacturer of soft drinks and confectionery has at his command.

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LIQUID APPLE PRODUCTS

(Part II)

During the last war, Professor B. T. P. Barker, Director of the Long Ashton Research Station, organised a scheme for utilising part of the heavy apple crop of 1917 by converting the juice to a concentrated jelly. The 1939 crop turned the thoughts of the Long Ashton workers to this pioneer effort of their directors, and early last September samples of jelly and "treacle" were prepared. These and other concentrated apple products are here discussed by

VERNON L. S. CHARLEY, B.Sc.

DURING THE last war, Professor B. T. P. Barker, Director of the Long Ashton Research Station, organised a scheme for utilising part of the heavy apple crop in 1917 by converting the juice into a concentrated jelly. Two centres of production were established at Long Ashton and Wedmore in Somerset, and despite the difficulties inherent in a scheme which was devised at short notice, a large tonnage of jelly was satisfactorily prepared. One of the chief difficulties was associated with obtaining a standard product from fruit which altered from day to day in its composition with respect to sugar, acid and tannin, the three most important constituents from the taste point of view. Variability of the pectin content of fresh juices was so considerable that there was difficulty in achieving a standard consistency of set, some jellies being too hard and others too soft.

The 1939 crop turned the thoughts of the Long Ashton workers to this pioneer effort of their Director's, and, early in September, samples of jelly and "treacle", a highly concentrated juice from which the pectin had been removed, were prepared on a Kestner machine fitter with an ester separator and condenser. The results were attractive, although certain problems soon presented difficulties, but the possibility of an acute sugar shortage suggested that the processing of surplus apples into concentrated products with natural sugar contents up to 75 per cent. should make an appeal to the food authorities. The writer was fortunate in being able to arrange for a large Kestner plant with an hourly input of 550 gallons juice to be placed at his disposal for the scheme, and all arrangements for transport of juice from several pressing stations in Somerset had been worked out. But, alas for human hopes, no official backing or interest could be obtained, and the scheme for utilising 10,000-15,000 tons of apples fell through, and undoubtedly that quantity of fruit, containing 800-2,000 tons of sugar, was never processed in any other way and was allowed to rot.

Drawbacks in Concentrated Products

The chief drawback in the concentrated products is the fact that the flavours of acid and tannin are extremely strong in the final product. The precise intensity of bitter or sharp flavour varies with the fruit used, and bitter-sharp cider apple juices will provide jellies or treacles which are uneatable. Again, sharp cooking apples will yield products unbalanced only with regard to acidity, the astringency being quite low. At the other end of the scale are sweet, low tannin apples which provide well-balanced concentrates. Now, whilst it is not possible conveniently to reduce the tannin content (gelatin treatment denatures the juice with repect to other constituents), the acid content can be considerably reduced by the use of potassium carbonate or pure precipitated chalk at a rate of 2-3 lb. per 100 gallons of juice. By this means, cooking and dessert apple juices

The author (in foreground) working at a Kestner pilot plant for the concentration of apple juice at Long Ashton.

can be converted into thick, very sweet concentrates with characteristic apple flavours, which are much more intense and true to type if the concentration plant is adapted to recover the volatile products with a view to their eventual return to the jelly or treacle.

Treacle must remain fluid, and most dessert and cooking apple juices contain sufficient pectin to set the final concentrate into a jelly. Consequently it is necessary to effect a controlled removal of pectin prior to concentration; this is conveniently done by a pectin-decomposing enzyme used for 12-18 hours at a concentration of 0·1 per cent. The concentrate can then be taken to very high sugar concentrations without any danger of gelling.

Blending introduces a further problem, but it is suggested in a full account of the whole subject in the Annual Report of the Station for 1939 (available May, 1940) that the most appropriate line of attack would be to proceed during the fruit season to concentrate depectinised apple juices to a very high soluble solids content, say, 75 per cent. This material will store safely in sound barrels, and in this way approximate compositions for various days' outputs can be determined. Later, when further processing is required, blending can be proceeded with by using the various batches in proportions as dictated by the individual compositions of the various batches. The material in this form can be used for the following purposes:

(*a*) Sold in bulk for sweetening purposes (*i.e.*, cider and mineral water trades; confectionery and special bakery products).

(*b*) Sold retail in cans or bottles to domestic consumers for dilution as a drink or for use with cereals, or as a substitute for golden syrup.

(*c*) Converted into a jelly by warming the concentrate with one-tenth its volume of liquid apple pectin, and filling into cans or jars. A minimum sugar content of 65 per cent. is essential to obtain a good set, but the rather high acidity of the jelly does not seem to cause syneresis—probably on account of the considerable buffering effected by some of the constituents of the juice.

The processes mentioned above have been elaborated during recent months and fuller details are available.

Existing Concentrated Products

An interesting ceremonial is regularly carried out in Jersey when the whole community gathers together to make "black butter". This consists of a large bulk of cider boiled to half its volume, to which peeled and quartered apples are gradually added over a period of many hours to the accompaniment of light-hearted songs in the local *patois*. At the end (after 24 hours boiling) the material is flavoured with lemon juice, spices and liquorice and filled into containers. The recipe is as follows:

10 gallons cider	3 lb. mixed spice
700 lb. sweet apples	3 sticks liquorice (chopped small)
20 lb. sugar	2 dozen lemons

The writer has obtained a small sample of the product and has found it to be most attractive.

Holland, Germany and France

Various semi-solid or solid apple juice products are made on the Continent. "Appelstroop" is a dark-brown, gelatinous confection containing only 30 per cent. of invert sugar but as much as 11 per cent. acidity. It is difficult to identify any apple flavour in the product, but the impression on the palate is extremely pleasant and this spread is very popular.

During the 1938 Horticultural Congress in Berlin the writer encountered various semi-solid materials of a similar type. In most of these it was thought probable that a concentrated apple juice product was used merely as a base and was cleverly flavoured with other materials. The consistency of the continental products is not easily explained. There is no definite gel structure, and it may be that the carbohydrates have been broken down into dextrinous and similar materials which have some "thickening" action.

Grocers' shops in Picardy, according to Miss Lorna Bunyard, of Maidstone, to whom the author is also indebted for some reminiscences of student days in Berlin, where she became acquainted with apple treacle, make

". . . the whole community gathers together to make 'black butter.' This consists of a large bulk of cider boiled to half its volume, to which peeled and quartered apples are gradually added over a period of many hours to the accompaniment of light-hearted songs in the local *patois*."

Courtesy: Jersey Weekly Post.

a great feature of a solid apple product sold in hard lumps similar to toffee. The product appears to be made from a juice that has been concentrated to the extreme limit. On one or two occasions at Long Ashton, when youthful zeal outran discretion, the end tube of the evaporator has become blocked with a brilliantly clear, golden mass of hard, crisp apple toffee. It has not yet been possible to examine in more detail the manufacture of this type of material, but its attractive character invites further attention.

The research department of the Metal Box Co. have recently examined a wide variety of uses for apple treacle in foodstuffs. One recipe relates to the production of cakes without added sugar, the sweetness being imparted by means of apple treacle. Here is the recipe:

Apple Treacle Cake

Long Ashton apple treacle ..	6 oz.
Flour	8 ,,
Butter	2 ,,
Sultanas	4 ,,
Mixed peel	2 ,,
Milk	5 ,,
Salt	pinch
Baking powder	½ teaspoonful
Sod. carbonate	½ ,,
Mixed spice	½ ,,

Very satisfactory products have been obtained, and this means of saving sugar is now being examined by various firms of confectioners and bakers.

The Sugar (Weights and Measures) Order, 1940

STATUTORY RULES AND ORDERS
1940 No. 22

THE SUGAR (WEIGHTS AND MEASURES) ORDER, 1940.
DATED JANUARY 8, 1940

WHEREAS it appears to the Minister of Food to be necessary for maintaining supplies and services essential to the life of the community and expedient that this Order should be made:

Now, therefore, in pursuance of the powers conferred upon him by Regulation 55 of the Defence Regulations, 1939, (a) and of all other powers him enabling the Minister of Food hereby orders as follows:

1. In this Order:

"Pre-packed" has the same meaning as in the Sale of Food (Weights and Measures) Act, 1926(b).

"Sugar" has the same meaning as in the Rationing Order, 1939(c).

2. (1) A person shall not sell sugar by retail otherwise than by net weight except that, where sugar is weighed for sale in a wrapper or container the weight purported to be sold may include the weight of the wrapper or container if the weight of the wrapper or container does not exceed for a parcel not exceeding three pounds in weight four and a half drams and for a parcel exceeding three pounds but not exceeding seven pounds in weight three and a half drams per twelve ounces of sugar sold and for a parcel exceeding seven pounds in weight three drams per pound of sugar sold.

(2) A person shall not sell or have in his possession for sale any prepacked sugar unless—

(*a*) such sugar is made up for sale in quantities of two ounces or in multiples of two ounces up to a limit of eight ounces, in multiples of a quarter of a pound up to a limit of four pounds or in multiples of twelve ounces or one pound, and

(*b*) the wrapper or container bears thereon or on a label securely attached thereto a true statement in plain characters of the minimum net weight of the sugar contained therein or the minimum weight of the sugar with its wrapper or container;

Provided that in the case where the sugar is made up for sale on the premises where it is sold or kept for sale by a retailer and is made up in any of the above-mentioned quantities it shall not be necessary that such a statement as aforesaid shall be borne on or attached to the wrapper or container.

(3) Any such statement as aforesaid shall not be deemed to be untrue if it is shown that it was true at the time of packing or of importation whichever was the later and the original wrapper or container has remained intact.

(4) A person shall not sell by retail any sugar other than prepacked sugar in quantities other than two ounces, four ounces, eight ounces, twelve ounces, one pound or multiples of twelve ounces or one pound unless:

(*a*) the sugar is weighed in the presence of the purchaser and forthwith delivered to him; or

(*b*) the sugar is delivered to the purchaser accompanied with a legible statement of its weight.

(5) The foregoing provisions of this article shall not apply to the sale of any sugar for consumption on or at the premises of the seller or to sales by the single pennyworth or less than one pennyworth or to sales in quantities purporting to be less than two ounces.

3. Infringements of this Order are offences against the Defence Regulations, 1939.

4. This Order shall not apply to Northern Ireland.

5. This Order may be cited as the Sugar (Weights and Measures) Order, 1940.

(*a*) S. R. & O. 1939, No. 927.
(*b*) 16 & 17 Geo. 5 C. 63.
(*c*) S. R. & O. 1939, No. 1856.

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THE SUGAR (WEIGHTS AND MEASURES) ORDER, 1940

In exercise of the powers conferred upon him by Regulation 55 of the Defence (General) Regulations, 1939, and of all other powers him enabling the Minister of Food hereby orders as follows:

1. The Sugar (Weights and Measures) Order, 1940 (hereinafter referred to as "the Principal Order"), shall be amended by inserting in paragraph 1 of Article 2 thereof immediately after the words "four and a half drams" the words "per twelve ounces of sugar sold."

2. Copies of the Principal Order hereafter to be printed under the authority of His Majesty's Stationery Office shall be printed with the amendments provided for by this Order and the Principal Order shall take effect as hereby amended.

* * * * *

The term "Sugar" is defined in Section 1 (m) of the Rationing Order, 1939, in the following terms:

"Sugar" means any sugar which has been subjected to any process rendering it suitable for human consumption, but does not include invert sugar, glucose, molasses, syrup, treacle or manufactured products containing sugar.

ENZYMES IN FOOD MANUFACTURE

Of biological agents in the preparation of food products the enzymes are one of the most important and their application in food manufacture is receiving increasing study.

S. M. TRITTON, M.P.S., F.I.C.

EVERY YEAR the technology of food manufacture increases in importance. New products are constantly being evolved, existing processes of manufacture are being improved and greater use is being made of biological methods in the preparation of food products. Of biological agents the enzymes are one of the most important and their application in food manufacture is receiving increasing study.

Origin and Nature of Enzymes

All vegetable and animal matter contains enzymes in its cell structure. They are generally present in minute quantities and in great dilution and, in many cases, when separated from their cell, will retain their activity. Such enzymes are termed endo-enzymes. On the other hand, some enzymes only remain active in the presence of a colloidal carrier, as it has been found that on dialysis the colloidal part of the enzyme which is non-dialysable is essential for the performance of the enzyme. This colloidal residue is called the co-enzyme and there are many known cases of enzymic activity depending on it. For instance, the enzyme thrombin depends for its activity on the co-enzyme thrombokinase, while zymase requires cozymase for its proper functioning. Enzymes are capable of bringing about great changes, both in the cell and *in vitro*, without undergoing any change themselves; in other words, they are organic catalysts.

As with other catalysts, enzymes are very easily inactivated by unsuitable *p*H and temperature, and very often so by the products of reaction. For instance, catalase, an oxidising enzyme, will not function in an acid or exceedingly alkaline reaction, and most enzymes show their greatest activity at an optimum *p*H and temperature, a figure which varies for most enzymes. This fact is very important in food manufacture, as by a careful control of the conditions it is possible to arrange for the functioning of any one enzyme, even when others are present. Salts, which have a buffering effect, are most important in the enzymic processes because they depress the hydrogen ion concentration and thereby prevent the inactivation of the enzymes.

Most biological syntheses and transformations are stimulated by enzymes which are found in great variety and profusion in yeast, moulds and bacteria, and in all cell life. Practically all enzymes are specific—*i.e.*, they will act on a particular substrate to form one particular type of product. The majority of enzyme reactions are hydrolytic and degradation products are formed, but some have oxidising properties, such as catalase, peroxidase.

The Enzyme Catalase

This is found in practically all cell life and in abundance in animal products and is somewhat in a class of its own, as its function is the decomposition of hydrogen peroxide with the liberation of oxygen. Practically all cell life, whether animal or vegetable, requires oxygen for its metabolism. The only exceptions are the anaerobic bacteria which lack catalase.

The physiological action of catalase is explained on Wieland's dehydrogenation theory. His experiments were carried out with biological material and inorganic catalysts. He used typical hydrogen acceptors, such as methylene blue, to prove his point that the H_2O_2, which would be formed by the activation of hydrogen with molecular oxygen, is at once oxidised by platinum to H_2O. Dehydrogenation by oxygen, the chief acceptor in the processes which occur in the cell, proceeds as follows:

$$XH_2 + O_2 \longrightarrow X + H_2O_2$$
$$H_2O_2 + \text{Catalase} \longrightarrow H_2O + \tfrac{1}{2}O_2.$$

As hydrogen peroxide is extremely toxic to plant life, catalase is considered to have a general functional significance in the metabolism of the cell.

The Classification of Enzymes

Enzymes are classified according to their function, in other words, whether they are oxidising or hydrolytic or show some other characteristic property. By far the larger proportion of enzymes are hydrolytic, a few are oxidative and, as far as specific activity is concerned, the fermenting and the clotting enzymes are the only ones of interest in food manufacture. As the enzymes are so widely distributed in nature and are present in great variety in moulds and bacteria, only their chief sources can be mentioned.

The Proteolytic Enzymes

On the whole, not much use is made of proteolytic enzymes in food manufacture, but they serve a useful function in the production of bread. Yeast and malt flour contain proteases and their effect on gluten is very pronounced in that a softer crust is produced. Other enzymes enter into the manufacture of bread and will be discussed under this heading. Beer also contains proteolytic enzymes, and in view of this is a suitable complement to a meat meal. This class of enzyme is often very detrimental to food products. They are present in moulds and yeasts, and are the cause of liquefaction in gelatin in jellied food products. Moulds also contain pectolytic enzymes, which are capable of doing con-

siderable damage to food products, but, on the other hand, they are now employed as important clearing agents in the manufacture of fruit beverages.

Pectase, Pectinase and Pectosase

All fruits contain a considerable quantity of protopectin or pectase which, on hydrolysis with acids, or by the action of pectosase, becomes converted from an insoluble cellulose-like body into a soluble colloidal substance, pectin. This colloid is of great significance in jam manufacture, as, without it, jelly formation would be impossible. Very often fruit contains insufficient pectin and extraneous pectin has to be added. Pectin, in its turn, is acted on by the enzymes pectase and pectinase to form non-colloidal degradation products. Both these enzymes are present in the fruit and are concerned with the ripening and rotting of fruit, which explains why firm, ripe fruit makes a better jam than mushy fruit, and also why fruits, rich in pectase, are apt to show poor jellying properties when manufactured into jam.

As mentioned previously, enzymes are sensitive to heat and cold, and the cold storage of fruit owes part of its effectiveness to the depression of the activity of the enzymes by cold.

Pectolytic enzymes serve a very useful purpose in the clarification of fruit, and moulds, such as Aspergillus, contain pectolytic enzymes. The pectin present in fruit juice is, from the manufacturing point of view, a decided drawback. Filtration of the juice is very slow and the filters are apt to clog. Also, the yield is low, as it is not possible completely to extract the juice from the cells. By the use of a preparation of clarifying enzymes, obtained from species of Aspergillus added to the pulp in quantity of about 0·2 per cent., rapid thinning takes place. The pectin is hydrolysed to non-colloidal pectic acid, which precipitates and carries down albuminoid matter thus forming a bright, clear liquid, which is easy to filter. Filtragol is another enzymic preparation used for such purposes in a quantity of 10 lb. to 50 gal. of pulped fruit, and again greater yields of juice are obtained.

The Sucrases or Sugar-Splitting Enzymes

Three types are known—invertase, which attacks cane and fruit sugar; maltase, which reacts with malt sugar; and lactase, which is specific for milk sugar. Of the first-named, invertase is the most important. It enters into bread manufacture, as does maltase, and is used in chocolate-covered, soft-centred candies as a liquefying agent. It is an endo-enzyme and obtained from yeast by autolysis or self-digestion. Invertase is an important factor in the processing of dates. The hard and dry fruit on treatment with heat becomes soft and translucent and much invert sugar is produced during the process. Lactase is present in some yeasts and in milk, and it plays its rôle in cheese manufacture.

Other Hydrolytic Enzymes

As regards food manufacture, apart from the fermenting enzymes used in the production of alcoholic liquors, diastase is of the utmost importance. Its chief function is in the manufacture of bread which, as other enzymes enter into this process, will be discussed under a separate heading.

Chlorophyllase is to be found in the presence of chlorophyll and is responsible for its destruction and consequent yellowing of the plant. It appears to be inactivated by heat, and blanching of vegetables is a usual procedure in their preservation by canning or freezing. Treatment by steam or boiling water not only helps to preserve the colour, but inactivates other undesirable enzymes which are the cause of bad flavours when vegetables are preserved by freezing. It was found that when catalase was destroyed, vegetables did not develop a hay-like odour. As catalase is known to be active at the temperature of freezing, it is very likely that this is the enzyme which is inactivated by blanching. Emulsin is an important enzyme found in the kernel of stone fruits, such as plum, apricot. It occurs abundantly in sweet and in bitter almonds and in cherry laurel leaves, and essential oil of almonds is formed by the action of emulsin on amygdalin, a glucoside found in the presence of emulsin. This essential oil is widely used in the manufacture of confectionery, such as marzipan and almond paste, and is sold as almond essence for flavouring purposes.

Sinigrase is present in mustard seed and liberates the pungent principle of mustard on grinding. Urease is not of much importance in food manufacture, while lipase is, on the whole, an undesirable enzyme. It liberates free fatty acids from fats and is the cause of rancidity in butter, margarine and all kinds of edible oils. Lipase, besides being a constituent of milk, is also found abundantly in bacteria and moulds and enters into cheese manufacture.

Last, but not least, among hydrolytic enzymes is tannase. It occurs in some fruits, such as unripe dates, which are very bitter but lose their astringency on ripening, and this is thought to be due to the activity of tannase. Persimmons are also very bitter and, if treated with sulphur dioxide previous to ripening, will not lose their astingency because sulphur dioxide inactivates the tannase.

The Oxidising Enzymes

Although not used as manufacturing agents, these enzymes can prove distinctly harmful and great attention should be paid to their inactivation.

Fruit and vegetables contain two oxidising enzymes—peroxidase, which is the cause of darkening in fruit, and ascorbic acid oxidase. The former is inactivated by exposure to sulphur dioxide, or by treatment with dilute brine. In the case of drying of fruits and vegetables, sulphur dioxide is resorted to, while in canning brine is employed. Ascorbic acid oxidase quickly inactivates ascorbic acid or, in other words, vitamin C. It has been found that fruits which have been treated with sulphur dioxide will retain their vitamin C, and in the case of fruit juice, a similar effect was obtained by flash pasteurisation to 190° F. Fresh milk also contains vitamin C, but only in small quantities, and as a source of this vitamin is not of great importance. Milk con-

tains another oxidising enzyme called Schardinger's enzyme, which is of the reductase type and is used, in conjunction with methylene blue, as a test for the freshness of milk. If reductase is present, the methylene blue becomes decolourised.

Zymase, the fermenting enzyme, the chief source of which is yeast, enters into the manufacture of all types of alcoholic liquors and of bread, while cheese manufacture depends on the clotting enzyme, rennin.

Flour contains several types of enzymes—proteolytic, sugar-splitting and diastatic. The most important is diastase, which is found abundantly in the germ of wheat and to some extent in the endosperm. It converts insoluble starch first into soluble starch and then into maltase, which, in its turn, is acted upon by the zymase of yeast. Carbon dioxide is given off in the process and causes the dough to rise. Proteolytic enzymes, found in malt flour and in yeast, have a pronounced effect on the gluten and will produce a soft crust, while other enzymes entering into bread manufacture are maltase and catalase. The catalase activity has been advocated as an index of flour grade.

Enzymes in Tea, Cocoa, Coffee

The plants from which the above beverages are prepared all contain enzymes, and they partly owe their characteristic flavour to enzyme activity. Tea, for instance, is marketed either as green or black tea. The former is prepared from leaf, the enzymes of which have been inactivated by heating, while in the case of black tea enzyme activity is stimulated to its utmost by the process of manufacture. In the production of black tea the leaf first undergoes withering, is then rolled, and when the cells are well disintegrated fermentation is allowed to take place, when the oxidising enzymes are responsible for most of the changes which occur. Enzymes affect the tannin content, which is as follows:

Fresh leaf, 22 per cent.; Withered leaf, 22 per cent.; Fermented leaf, 13 per cent.

When fermentation has proceeded to the desired stage, further enzyme activity is prevented by heating to no less than 170° F. Green tea is prepared from the fresh leaf by pan firing, which inactivates enzymes, and rolling and firing.

The cocoa bean and pulp are reputed to contain oxidase and raffinase in the fresh bean, while after fermentation, proteases, diastase and invertase have been found. The colourless, water-soluble, bitter cocoa tannin is converted on fermentation to an insoluble, coloured and non-bitter product. Coffee seeds are stated to contain proteolytic, amylytic and catalytic enzymes, but not lipase and little peroxidase.

Enzymes in the Manufacture of Cheese

The production of cheese depends directly on the clotting enzyme, rennin. This is naturally present in milk, but as it is sometimes desirable to cut out the activity of other enzymes, in some kinds of cheeses the milk is first heated and the clotting carried out by adding rennet after heating.

Other enzymic actions taking place are due to proteolytic enzymes of the lactic acid bacteria which break down the peptones into amino acids. These have also an influence on the ripening of cheese, in which moulds play their part. Camembert and Brie are matured and their flavours developed by external mould growth, while Roquefort, Stilton and Gorgonzola all show internal mould development. The sharp peppery flavour of Roquefort is due to lipase, which liberates the pungent caprylic, capric and caproic acids.

The possibilities of employing enzyme in food manufacture are very great and new developments along these lines are constantly being made.

HYDROLYTIC ENZYMES.

Name of Enzyme.	*Chief Source.*	*Type with Reference to Substrate.*
Bromelin	Juice of pineapple.	Proteolytic or protein-splitting enzymes.
Pepsin	Lining of stomach.	Proteolytic or protein-splitting enzymes.
Trypsin	Pancreas.	Proteolytic or protein-splitting enzymes.
Papain	Juice of plant, *Carya papaya*.	Proteolytic or protein-splitting enzymes.
Pectosase	In plant and fruit tissues, also in moulds.	Protopectin-splitting enzyme.
Pectase	In plant and fruit tissues, also in moulds.	Pectolytic enzyme attacks pectin.
Pectinase	In plant and fruit tissues, also in moulds.	Pectolytic enzyme attacks pectin and pectic acid.
Invertase	Yeast.	Sucrase or sugar-splitting enzyme (cane or fruit sugar only).
Maltase	Malt extract.	Sucrase—malt sugar only.
Lactase	A special type of yeast, *Saccharomyces fragilis*; also in milk.	Sucrase—malt sugar only.
Diastase	In sprouted grain and in many moulds.	Amylase or starch-splitting enzyme; converts starch and glycogen into malt sugar.
Chlorophyllase	In green vegetable matter.	Causes loss of colour by oxidising chlorophyll.
Emulsin (also termed β-glucosidase)	Found in kernel of stone fruits, almonds, plums, some leaves like cherry laurel.	Breaks up amygdalin into benzaldehyde and free HCN.
Sinigrinase (also termed Myrosin)	In mustard seed.	Acts on sinigrin to yield volatile oil of mustard.
Urease	In jack bean.	Splits up urea.
Lipase	Occurs together with fats in plants and abundantly in sprouted castor bean.	Esterase and fat-splitting enzyme.
Tannase	Moulds, some fruits.	Decomposes bitter gallo tannin to non-bitter gallic acid and glucose.

PROCESSING STAPLE FOODS

A brief account of the trend of food research in Canada.

HENRY B. BEES

ONE stubborn fact is that physical labour on the part of human beings and of animals, too, is gradually giving way to the work of the creatures of science—machines. With the decreasing amount of physical energy employed, it follows that less energy-producing food is consumed than in the days of more pick-and-shovel work.

In spite of ultra-efficient and rapid transportation, the business of moving bulky articles from one part of the world to another is an expensive one. Therefore we note the tendency towards eliminating needless bulk and unnecessary weight; for instance, dry ice is replacing water ice in refrigeration for transport; fish, beef, etc., is exported in cans; fruits, potatoes, and other vegetables are dehydrated before shipping. Every country to-day, through a scientific service of experts, is striving towards more efficiency in growing and marketing foods, and particularly in processing them, so as to save freight charges and to meet the somewhat coy demands of fickle markets.

Baking Strength in Wheat

Exhaustive experiments have been carried on in the Grain Research Laboratories of Winnipeg for some years to determine the source of "baking strength" in wheat. The general results go to prove that the higher the protein content in the wheat the greater the baking strength. For this reason the laboratory issues a map every year, after analysing from 10,000 to 12,000 samples from approximately 2,000 shipping points, showing regions where wheat of high, medium, and low protein content is grown. There appears to be a close connection between protein content and gluten-quality, though the former is a chemical characteristic, while gluten depends more on physical properties, such as elasticity in the dough. Last year (1938) experiments were conducted to investigate the possibilities of separating gluten from the flour by repeated washing of dough in tepid water. The resulting wet gluten was divided into small pellets, dried, and ground to a flour-like fineness. It was further found that this powder, when mixed with so-called "weak" flours, improved their baking strength considerably. The dried gluten increased absorption, improved dough-handling characteristics, increased loaf volume and enhanced the appearance and crumb texture of the loaf. It may be seen from this that there is a possibility of exporting gluten in quantities, instead of merely shipping wheat or flour. Countries raising inferior wheat in regard to gluten content will be able to purchase this gluten from Canada, and thereby improve the quality of their bread.

Milk Products

Various milk products, such as different types of cheese, evaporated milk, unsweetened or sweetened, and milk powder have been familiar for years past, and are sold in all grocery stores. Further developments of milk products are likely in the near future. One commercial use of the casein part of milk is seen to-day in the production of aeroplane glue, while its extensive use to make a textile fibre is noticed in Italy. Sweet butter milk powder is now being used in some parts of the United States in the manufacture of ice-cream. At present the biggest waste in the dairy industry of North America is lactose or milk sugar. Lactose promotes growth in animals without excessive fattening.

It is now used in explosives as a substitute for glycerine, but its further use is predicted in various foods for human beings and animals. It is estimated that when skim-milk is fed to animals on the farm only 10 per cent. of its value appears in the meat from the animals fed, and that this skim-milk could be better utilised in other ways as human food, so that research along this line is being continued in laboratories of the United States.

Potato Starch

The climate of Canada seems particularly well suited to the growing of potatoes, and there is usually a surplus of the tubers. Accordingly, in Canadian research laboratories, some studies have been recently made as to the merits of potato starch for a number of purposes, industrial and otherwise. The principal motive for these experiments was to discover whether potato starch would conveniently take the place of the corn starch so widely used in Canada, and mostly imported. Two of the largest uses of corn starch have been for laundry work and cooking, so that along these two lines most of the tests were directed. Three power laundries in Canada reported that the potato starch gave excellent results in all classes of work, and that, with possibly some modifications, it was useful for household laundry purposes. For general cooking uses the ordinary potato starch was found definitely unsatisfactory, but with certain inexpensive changes the commodity was found to be of value in cooking, and also suitable for some branches of confectionery manufacture. Two other valuable uses for potato starch were found in the sizing of bond paper of a high grade, and, when suitably roasted, as a source of dextrin or British gum. Vegetable glue from potato starch, though inferior for furniture veneer-

(*Continued on page* 150)

THE RIPENING OF CHEESE

Professors A. Wojtkiewicz and G. Inikkoff

THE acceleration of the reactions taking place in the curd might be obtained in three ways: by raising the temperature, by modifying the reaction of the medium, and by increasing the concentration of the substances reacting on one another.

The raising of the temperature of the ripening of cheese can only be obtained within somewhat restricted limits, as every deviation of the temperature from the normal affects unfavourably the physical properties of the cheese. It therefore does not offer a radical solution of the problem.

The second solution appeared to be more promising. Experiments were made in introducing into the milk and into the cheese various chemical reagents in all sorts of combinations: lactose, lactic acid, phosphates, carbonates of calcium and sodium, etc. The experiments did not give positive results, as some of the substances modified the reaction of the medium in an unfavourable sense, others affected the physical condition of the curd, some checked the ripening of the cheese, and those which increased the degree of ripeness (citronates) affected the quality.

There remained the third method of raising the concentration of the ferments of the curd. As the production of ferments is due for the most part to the bacteria which multiply in the curd, it seemed necessary to introduce the ferments into the cheese from outside or to increase the number of microbes.

The introduction of ferments was done by the addition of preparations, erepsin, pepsin, trypsin and rennet being used separately or in combinations. Pepsin alone gave no results. Rennet and trypsin intensified the ripening considerably, particularly trypsin, where in one month a degree of ripeness of Edam 42·42 was reached, but its use cannot be recommended on account of a bitterness in the cheese.

Other experiments were made with autolytic agents added to the milk, such as yeast and *Streptococcus lact.*, as well as rod bacteria. 3·2 per cent. of serum rendered autolytic by *Streptococcus lact.*, with *B. Bulgaricus* and *B. casei* added to the milk, caused a slight acceleration. A better effect was obtained by adding yeast to the milk, but it left a disagreeable after-taste. This process cannot therefore be recommended.

Lastly, experiments were made with the inoculation of an increased number of lactic acid bacteria cultivated on a medium of chalk to eliminate the harmful influence of surplus acid. Three stocks found to be the most active were used for the experiments. It was possible in this case to ascertain that all the bacteria were psychophilic. They were cultivated at low temperatures for a prolonged period and they continued to multiply at temperatures of from 1° to 3° C. The stocks in question were equally characterised by proteolytic activity and by their acidification capacity. Cheese made from pasteurised milk was used to which 0·4 per cent. of bacteriological yeast was added. Ordinary cultures were used as a check. The selected stocks produced a considerable acceleration of the ripening. Cheeses one month old were equivalent in respect of their ripeness to cheeses 2 to 2½ months old prepared in the ordinary way.

The use of certain combinations of selected stock of *Streptococcus lact.* and of *B. casei* and yeasts also gave satisfactory results. By their use acceleration in the ripening and improvement in the taste are obtained.

CANADIAN WHEAT AND SELENIUM

The Director of the National Research Council of Canada, in the following letter, has pointed out that the work of Byers and Laken, reviewed in the February 2 issue of *Food Manufacture*, may have caused some apprehension that selenium might be present in dangerous amounts in some parcels of wheat imported from Canada.

DEAR SIR,

The occurrence of selenium in Canadian wheat was discussed at a recent meeting of our Associate Committee on Grain Research. The Committee felt that the work of Byers and Laken, reviewed in your issue of February 2 under the heading "Canadian Wheat and Selenium", may have caused some apprehension that selenium might be present in dangerous amounts in some parcels of wheat exported from Canada. Fortunately, an extensive investigation by Thorvaldson and Johnson has shown that there is no possibility of this occurring. A report on this work has just been published in the *Canadian Journal of Research*, and I am enclosing a pre-printed copy.

The plants analysed by Byers were mostly the so-called "indicator" species, which require selenium for proper development. Only four samples of seedling wheat plants and none of grain were included. Thorvaldson's results are based on 2,230 samples of wheat grain, a sufficient number to give an accurate picture of the conditions in the main wheat-producing area of Western Canada. The growth of rats is adversely affected by diets containing six parts per million of selenium, but no effects are obtained with diets containing less than three parts per million. The highest concentration of selenium in the wheat samples was four parts per million, and this was in the only sample containing more than three parts, so that only one sample out of over 2,000 could possibly be suspect even in a diet consisting entirely of wheat. The average selenium content was less than half a part per million. It is highly probable that the wheat exported approximates this value because of the great amount of mixing of wheat from different areas that takes place before wheat reaches the seaboard. This concentration of selenium is, of course, entirely harmless.

The Committee would be deeply appreciative if you would call attention to Thorvaldson and Johnson's results in the same manner that you did with Byers and Laken's.

Yours sincerely,

J. G. MALLOCH.

(For the Director.)

NEW FOOD COMMODITY

SOME time before the outbreak of hostilities the Danish firm of manufacturing chemists, Christian Hansens Laboratorium, introduced an interesting new commodity on the export market, especially in the United States of America. The staff of the firm found a new manufacturing process, by means of which *roedgroed*, a national Danish dish, which may be described as a cross between fruit jelly and porridge, may be converted into powder form. Packed in tight packages, this powder forms *roedgroed* when diluted with water. It contains a mixture of sugar, tapioca meal and fresh fruit such as raspberries, blackcurrant and currant. This seems to suggest possibilities for the preservation of fruits in this country, especially in times of glut.

THE INVERSION OF SUCROSE

An account of previous investigations and some interesting experiments made by the author.

ERIC HUMPHRISS, A.I.C., F.R.M.S.

THE IMPORTANCE of utilising to the greatest advantage the restricted supplies of sugar available to the food industry under present conditions requires no emphasis here.

The possibility of increasing the sweetening power of a given weight of ordinary sugar (sucrose) by the simple process of inversion appeared an attractive proposition worthy of investigation.

Soon after the outbreak of war, therefore, the author examined the proposition and its possible application to the solution of the sweetening problems facing that part of the food industry with which he is most closely concerned.

Previous Investigations

A review of the literature reveals conflicting results. H. A. Ruehe[1] gave, as long ago as 1918, explicit quantitative directions for the hydrolysis of a concentrated sucrose solution by boiling for half an hour in the presence of tartaric acid. 100 lb. of sucrose, by such treatment, was said to yield 144 lb. of "invert syrup", which was equal in sweetening power, weight for weight, to sucrose. Frandsen *et al.*[2] in 1919 reported that a 22 per cent. saving in sugar could be effected, due to the increased sweetness resulting from hydrolysis with tartaric acid. Dahle[3] in 1924, in the course of an article, published a table of relative sweetness values of several carbohydrates wherein he rated sucrose at 100, invert sugar at 120, and lævulose at 164. Sale and Skinner[4] in 1924 concluded, amongst other things, that since 342 grm. (1 grm. molecule) of sucrose on hydrolysis yield 180 grm. each of dextrose and lævulose, and since the relative sweetness of invert sugar is 85 per cent. that of sucrose, then the net result of the inversion is a loss of some 11 per cent. sweetening power. Mojonnier and Troy,[5] who quote Sale and Skinner, conclude that investigators are not agreed as to the merits of inversion as a means of enhancing sweetening power.

P. S. Lucas[6] in 1930, in a tabular summary of the sweetening power of several "sugars" suggested for use or actually used in ice-cream, assigns to invert sugar a sweetness value equal to 72½ per cent. that of sucrose. Washburn[7] in 1933, on the other hand, writing of lævulose (described as "super-sugar"), gives a table of sweetening values wherein invert sugar is listed as 120 compared to sucrose 100 and lævulose 164.

Perkin and Kippin[8] state that fructose (lævulose) and dextrose (glucose) are just about equal in sweetness.

It does appear, from this brief review of such literature as the author had ready access to, that some diversion of opinion exists as to the results to be anticipated from sucrose inversion.

Theoretically, if the generally accepted relative sweetening power of pure dextrose be assumed correct (0·70 to 0·75 as sweet as sucrose), then lævulose would have to be 1·15 times sweeter than sucrose in order that the sweetness of the invert sugar might equal that of sucrose, and would require to be 1·68 times sweeter if the more optimistic relative sweetness values claimed for invert sugar were found to be valid.

Complete Hydrolysis

The present investigation was first concerned with laboratory tests to ascertain the minimum heat plus acid treatment necessary to ensure complete hydrolysis. Concentrated sucrose solutions were used since this practice would be essential in any application of the results obtained in the laboratory to ice-cream manufacturing practice. An aqueous solution containing 30 grm. of sucrose per 100 ml. of solution was therefore used. The results obtained can be summarised as follows:

Complete inversion was attained by 15 minutes' boiling in the presence of 0·20 per cent. of citric acid. Inversion was also found to be complete after ten, but not after five minutes' boiling in the presence of 0·10 per cent. citric acid. At mix pasteurisation temperatures (155° to 165° F.) hydrolysis was too slow to be of practical use; using 0·40 per cent. citric acid, for example, inversion was only 60 per cent. complete after 2½ hours at 160° to 165° F.

Having ascertained the minimum effective time/temperature conditions and acid concentrations likely to fit in most comfortably with normal ice-cream processing procedure, one or two other points germane to the problem were investigated.

It was considered that the activity of the ionised hydrogen derived from the acid would be confined to the catalysis of the inversion; but the idea that the steric symmetry of the acid catalyst molecule might influence the inverted dextrose—lævulose equilibrium, and therefore the "sweetness" of the invert sugar, was thought to be a bare possibility.

Accordingly, in an effort to check up on the idea, and also to obtain some preliminary evidence "for" or "against" the increased sweetness contention, the following experiment was made and repeated.

Is Invert Sugar Sweeter?

Both 10 per cent. and 20 per cent. aqueous sucrose solutions were inverted by boiling with approximately 0·10 per cent. concentrations of (*a*) citric acid, (*b*) tartaric acid, and (*c*) hydrochloric acid. The completeness of inversion and titratable acidity were checked analytically, and careful "blind" tasting tests were made on (1) the acid, and (2) neutralised solutions in an effort to select the sweetest. Uninverted sucrose solutions, with and without the equivalent amount of neutral salt added, were used as controls. Though the results of the organoleptic tests were by no means concordant (which is often the case where the human sensory organs are the experimental tools), it appeared on balance that the inverted sugar solutions tasted slightly sweeter than the originals. This result was qualified by the observation that the invert sugar sweetness was "different" and "less permanent" than the sweet taste of ordinary sugar.

No organoleptic evidence whatsoever was obtained which indicated any difference in sweetness between the inversion products of mineral acid (HCl), citric acid or tartaric acid. This would appear to dispose of the notion that the asymmetric carbon atom (tartaric acid) is active in the sense envisaged above.

Sweetness in Ice-Cream

The next step was to test the problematic increase in sweetness actually in ice-cream. This involved translating the experimental work on to a semi-technical scale, and in order to do this trial batches of ice-cream

mix were made up from the usual ingredient combinations to test:

Fat	10 per cent.
M.S.N.F.	10 ,, ,,
Sucrose	9½ ,, ,,
Total solids	30 ,, ,,

Assuming a modest increase in sweetness consequent upon inversion of only ⅛—*i.e.*, that the sweetness ratio of sucrose to invert sugar be as 1 is to 1·2—then the 9½ per cent. of inverted sucrose would equal in sweetness 11·4 per cent. of uninverted sugar. Comparatively "blind" tasting tests were therefore made by an expert tasting panel and also by a miscellany of ordinary palates, using above mixes as "test" against "standard" 11 per cent. uninverted sucrose mixes.

In spite of the additional slight advantage (0·4 per cent.) conceded, no evidence in favour of the "increased inversion sweetness" theory was obtained. The 9½ per cent. inverted sucrose mixes were always rated less sweet than the 11 per cent. uninverted standard. Inversion in these semi-technical scale experiments was effected with both citric and tartaric acids, the completeness of inversion checked by copper reduction titrations, and the acids neutralised with the stoichiometrical quantities of sodium bicarbonate, prior to completion of the compounding of the mix. Fat and total solids estimations were also performed on the finished products and showed close agreement with the theoretical analysis.

Yeast as an Inverting Agent?

A few experiments, on a laboratory scale, were made with an aqueous yeast extract, which, it was hoped, by virtue of its invertase content, might prove an effective inverting agent. The experiments, admittedly by no means exhaustive and very empirical in their planning and execution, were discontinued because of the autolysed "yeasty" odour of the substrate and the comparative slowness of the inversion.

It is concluded, from the experimental work briefly described above, that no advantage or gain in sweetening power accrues from the acid inversion of sucrose.

This negative conclusion is in accordance with some previously published work on the subject and is in contradiction to the findings of other workers.

No explanation of the results which are in disagreement with those now put forward has emerged as a result of present work.

The alleged considerably greater sweetness of lævulose compared to sucrose would also appear to be called in question. There is, of course, the possibility that the hydrolytic change:

$$\text{Sucrose} + \text{Water} = \text{Dextrose} + \text{Lævulose}$$

is rapidly followed by some change in the equilibrium

$$\text{Dextrose} \rightleftharpoons \text{Lævulose} \rightleftharpoons \text{Mannose}$$

to right or left, which would, granted the extra sweetness claimed for lævulose, be accompanied by a decrease in sweetness. Traces of alkali do, apparently, affect the equilibrium of these isomerides, and, though one or two experiments were made with the idea of throwing some light on the matter, they were discontinued as beyond the scope of the enquiry, which was related throughout to the practical business of making the most of the restricted sugar supplies available to the trade concerned.

It is unfortunate that no relief from his "sweet embarrassment" is on this occasion afforded to the food manufacturer by chemistry.

REFERENCES

1 Illinois Agric. Expt. Sta. Bulletin, Circ. 219, 1918.
2 J. H. Frandsen, J. W. Rovner and J. Luithly, *J. Dairy Sci.*, Vol. 2, No. 1, 1919.
3 C. D. Dahle, "Use and Value of Sugars in Ice-Cream," *I.C. Trade J.*, Vol. 20, No. 8, 1924.
4 J. W. Sale and W. W. Skinner, "Relative Sweetness of Invert Sugar," *J. Ind. Eng. Chem.*, Vol. 20, No. 8, 1924.
5 T. Mojonnier and H. C. Troy, *The Technical Control of Dairy Products*, Mojonnier Bros., Chicago, 1925.
6 P. S. Lucas, *Ice-Cream Field*, Vol. 17, No. 4, 1930.
7 R. M. Washburn, *Ice-Cream Industry*, October, 1933, p. 31.
8 W. H. Perkin and F. S. Kippin, *Organic Chemistry*, Chambers, 1922.

NEW FACTORY REGULATIONS

BY A BARRISTER-AT-LAW

SINCE the commencement of the present year, new Factory Regulations have come into force, particularly with regard to the treatment of different branches or departments of the same factory as different factories, and the conditions of employment of women and young persons.

The Factories Act generally requires that the periods of employment and the intervals for meals and rest are to be uniform throughout the factory. But if different branches or departments can be regarded as separate factories, the above rule can be modified. Before any such separation can take place, however, a certificate from the Minister will be necessary. Such a certificate can be granted under the Factories (Separation for Certain Purposes) Order, 1939, where there is some special circumstance, such as the difference in the nature of the work carried on in the respective branches or departments, or the varying transport facilities which are available for the different workers, which make the separation desirable. Where the factory operates the 5-day week, however, the distinction between the branches or departments must be sufficiently marked, and satisfactory arrangements for maintaining that distinction must be made in order that a certificate may be granted. In any event where a certificate is in force certain conditions must be fulfilled. There must be a notice that a certificate is in force; a notice, if so required, must be posted up stating the names of the women and young persons employed in each separate branch or department, and each such branch or department must have its own notices as to periods of employment and intervals for meals and rest.

The work of each separate branch or department must be carried on in separate rooms, or in parts of the factory separated from each other by a partition or distinguished from each other by a definite line of demarcation.

Each such branch or department must have its own separate staff of women and young persons, though the same manageress may manage more than one such branch or department.

Another order, the Young Persons under 16 (Factory Modification) Regulations, 1940, deals with the question of the periods of employment for young persons under 16 in factories where the permitted hours for such young persons are less than 48. In such a case their periods of employment, though they must be otherwise uniform, need not be the same as those for other young persons and women. But if young persons under 16 are employed in different sets, their periods of employment in one set need not be the same as in the other or others, though again the periods must be uniform so far as the same set is concerned. There may not be, however, more than two such sets or such greater number of sets as the Inspector may allow. A notice with the names of the young persons under 16 in each set must, however, be posted up if the Inspector so requires.

Finally, as regards certain factories, including factories where the business is carried on in connection with a retail shop on or immediately adjoining the factory premises, some other day may be substituted for Saturday as the short day, by virtue of the Factories (Saturday Exception) Regulations, 1940.

NEWS FROM THE INDUSTRY

COLOURS AND FLAVOURS

Orange Products

Empire products are now in demand, particularly in view of the fact that certain of them can be imported freely without the necessity of obtaining an import licence. H. Rubeck, the agent in London for Citrus Products, Ltd., of Southern Rhodesia, reports that the factory there is producing important quantities of concentrated orange juice, orange concentrate and orange oil, all of which can be supplied without any question arising in connection with the restrictions now in force regarding foreign currencies.

The orange juice is concentrated seven to eight times, without the addition of either flavouring material or sugar, and is claimed to have a very high vitamin C content.

* * *

Ground Ginger

From Jamaica comes a fine type of ginger which is uncoated, unbleached and buff in colour. When a piece is broken it appears starchy and fibrous, and on grinding the spice gives a light yellow powder. From this material Stafford Allen and Sons have produced a finely ground ginger for use in the food industries and with special reference to biscuit making. A great deal of attention has been paid to the elimination of "hairs and spines".

This firm specialise, among other things, in a wide range of butter flavours and also substitute butter flavours which it has been found necessary to introduce in many cases owing to war conditions. Since the outbreak of war, biscuit and food manufacturers have been experiencing more and more difficulties in obtaining raw materials, and it is becoming increasingly important that the flavours used should be good ones.

* * *

Colours and Flavours Classified

The new Price List recently issued by W. J. Bush and Co., Ltd., is a fine achievement, both in the way it is classified and also the amount of useful information that is contained therein. The compilation of such a work would have been a tremendous task at any time, but with conditions as they are it must have been doubly so.

The products are grouped into six main sections: (1) Flavouring essences; (2) essential oils; (3) colours; (4) perfumery products; (5) synthetic, fine and pharmaceutical chemicals and isolates; (6) sundry chemicals, extracts (medicinal and non-medicinal), gums, roots, spices and other sundry products.

Inside these main sections there are various sub-sections, thus ensuring that for every purpose for which the various products could be used, there would be a corresponding section in the price list.

In the colour section are contained details of harmless food colours in powdered form which are especially recommended for biscuits, cake icings, confectionery, fish and meat pastes and sausages, ices, and jelly crystals and squares. The Bonsanté Natural Food Colours for use in confectionery, being free from coal tar dyes, will conform to the legal regulations of most countries and comprise a long list.

A useful sub-section shows the colours to meet the requirements of Australian, Canadian and New Zealand pure-fruit laws. Fat-soluble colours, "non-speck" colours and caramel all have their place.

The biscuit, cake and bakery, and also the confectionery sub-divisions, are particularly interesting.

In showing flavouring essences and fruit juices much information is given in tabular form. Besides the name of the essence, there is the price, the amount to be added to the various types of confectionery, and under "Remarks" are given page references to Skuse's "Complete Confectioner", 12th Edition.

The firm may be congratulated on this production.

* * *

Lemon Oil

Established twenty years ago, the well-known house of T. Harrison and Co. has always offered outstanding quality in raw materials, probably the finest being "Mezzagno" Oil of Lemon Sicilian. Two qualities of Terpeneless Oil of Lemon are distilled by them from this "Mezzagno" oil.

Two years ago they introduced Van-B-Ness, which is a liquid vanilla flavour equal in strength to vanillin. It contains the main parts of the vanilla bean in highly concentrated form, and the flavour imparted to the finished product is very true. Van-B-Ness is now being used extensively both in the food and in the essence trade as it shows considerable saving as compared with vanillin.

Another series of products which merits the trade's attention is Fort. Fruit Juices Conc. 10, condensed in raspberry, strawberry and blackcurrant. These are especially recommended for the flavour of jellies, jams and fruit cordials, and all other products where a natural taste is required.

* * *

Flavourings

Now that the Budget has increased the spirit duty on essences, no doubt manufacturers will turn their attention to specialities which are claimed to prove more economical.

Vanoleum, for instance, has often been used to replace expensive alcohol, 1 oz. added to a pint of warm water producing a pint of vanilla flavouring. Besides being cheaper than alcohol, it has the advantage of not being so volatile. It will not burn out in baking or sugar boiling and will not freeze out in ices.

Sesquito, being the flavouring principles only of essential oils, can be added to essences to fortify them and make them considerably stronger, but for those who prefer their essences already fortified Arthur Whittaker supplies an ordinary essence concentrated eight times, marketed under the name Peak Brand Excelsior Extract.

* * *

Spice Grinding

Spice grinding is carried out by various methods, depending among other things upon the nature of the spices and the amount of oil they contain. Certain spices may be ground and sifted in a combination machine such as the "Rapid" grinder and sifter made by Wm. Gardner and Sons (Gloucester), Ltd.

In some instances it is necessary to dress the spices before grinding, and there is a special piece of equipment devised for this purpose, called a fine powder "Quick-Change" dresser. Other equipment includes either single or double roller grinding mills, the single roller having one pair and the double roller two pairs of hard chilled iron rolls of different diameters and lengths. Still another item is a combined grinder and dresser together with elevator and worm conveyor for taking back the tails for further grinding.

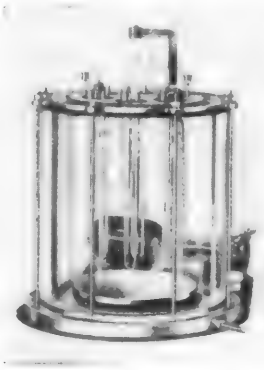
The addition of flavouring in liquid form may be effected in a combined sifter and mixer fitted with a sprayer. Should the flavouring be added in powder form, it is best to

use an end runner mill for grinding and mixing the flavouring material with a portion of the base product before adding to the bulk. Colouring matters, either liquid or solid, may be added to the product in the same way as flavouring materials.

TEMPERATURE CONTROL

The influence of temperature variations on physical phenomena and chemical reactions is often larger than that of all the other experimental errors together. Temperature is, however, seldom so closely regulated as it should be, because of the troublesome handling and inconvenience of the usual laboratory bath. Sometimes considerable auxiliary apparatus and expenditure of time is necessary to build up the bath from components, which frequently fail at the moment they are mostly needed. There are two methods for keeping the temperature constant in a laboratory apparatus: the instrument under observation is either submerged in a bath or a thermostatically controlled liquid flows through the instrument.

With the Steiner Constant Temperature Equipment it is possible to apply both methods at will, and, as far as our knowledge goes, it is the first time that an instrument of such universal application has been made



available. It consists mainly of: (1) A container, which is a double-walled tank, fully transparent, with a vacuum between the walls; (2) a motor-driven pump, which keeps the temperature exactly the same in all parts of the container. The liquid passes continuously heating coils, and variations of temperature can be adjusted very quickly; and (3) a thermo-sensitive element, either a mercury contact, a resistance thermometer, or a highly sensitive bimetallic strip, controls a relay which switches on or off one or more electric heaters. The working temperature can be adjusted and each thermo-sensitive element covers a range of about 70° C. or 130° F.

Precision of regulation is ±0·01° C. in the range between room temperature and 160° C., and will be appreciated by research workers as well as by the chemist or physicist engaged in routine tests.

The Steiner Constant Temperature Equipment can be applied in connection with the measurement of volume, density, viscosity, penetration, ductility, electrical resistance, conductivity, crystallisation, solubility, sedimentation, vapour pressure, refraction, turbidity, colour, reaction time, etc.

The equipment is manufactured by the C. L. Burdick Manufacturing Co., Ltd.

SALT MANUFACTURE

Salt Solution Ejector

Users of salt bath furnaces unanimously approve frequent clearance and changes of salt as the most effective method for maintaining the ideal chemical balance; freedom from contamination and corrosion of work; and—of equal importance—obtaining the longest possible life from the pot or container. Hitherto, the lack of rapid and effective means of salt transfer has seriously impeded regular cleaning out, and, under stress, such operations are often deferred until bath failure is apparent.

Present methods of discharge—viz., ladling out and cutting out of molten and frozen salt—involve considerable risk, expense and loss of valuable production time. The Incandescent Heat Co., Ltd., claim that their Incandescent Automatic Salt Ejector reduces the discharge effort to electric push button action, and the time factor from days to minutes. On test a 15 tons capacity salt bath is completely emptied in about twenty minutes.

Consequently, weekly or monthly cleaning out and inspection cycles may be adopted with the ease and simplicity of the average plant maintenance task.

CONVEYING PLANT

The extension of Glasgow Corporation's Power Station makes it one of the largest in Britain. The coal-handling plant was chosen for reliability, ease of erection, low running cost and long life—conditions which the manufacturers claim Mavor and Coulson conveyors have fulfilled.

The installation consists of a tray feeder receiving from the 50-ton bunker four troughed belt conveyors, two fixed trippers and one travelling tripper. Three of the belts are 36 inches wide, and can convey 300 tons per hour. The conveyors are arranged to receive either from railway wagons or from the coal store and deliver to the boiler house; alternatively they can take the fuel from the wagons to the coal store.

In the erection of these conveyors much weight was saved because inverted troughing which carries the idlers takes the place of stringers, decking and idler boards. The troughs are each 12 ft. long, and their ends are carried on the cross members of the structure.

Running friction is reduced to a minimum. The idler rollers have specially designed ball bearings, and their mechanical assembly prevents forcing and distortion. They are completely grit-proof; a grease labyrinth keeps the ball bearings clean by trapping any grit or dust in a narrow passage between two labyrinth washers. This is cleaned periodically from the inside and the dust and grit are carried out by clean grease forced out of the bearing by a grease gun.

CANNING

Lieutenant-Colonel H. H. Johnson, D.S.O., managing director of Jersey Canners, Ltd., was recently in London on a business trip and informed us that the progressive canning business of which he is head, trebled its previous output last year. Preparations for the coming season are well ahead, and potato and other vegetable canning will be started.

Tomatoes, concentrated tomato purée and tomato catsup form important items in the programme of the company.

Among his other activities Colonel Johnson is taking great interest in the question of the collection of waste paper and scrap iron, and mentioned that shipments of no less than 650 tons of scrap iron have recently been made from Jersey, which is a very good effort on the part of this island.

Metal Box Company, Limited

Will all users of *Food Industries Manual* please make a note in the main Index of their copy that the correct address and telephone number of the Metal Box Company, Ltd., is Queen's House, 28, Kingsway, London, W.C. 2. Telephone, Holborn 7551.

* * *

The Massachusetts Institute of Technology announces a Summer Programme in Food Technology under the direction of Bernard E. Proctor. This programme will be given from July 1 to 19 inclusive.

WAR-TIME PRODUCTION

Coal Gas for Transport

At a press conference held at Gas Industry House on Wednesday, May 1, under the chairmanship of Mr. S. C. Leslie, the following information was issued:

The use of gas for transport purposes is now practicable throughout the whole of Greater London. Owners of commercial vehicles and private cars can fill up with gas—which is not rationed—at 70 stations in different parts of the metropolis.

Conversion is simple. The bag is fitted to the top of the car or van and the gas is fed to the engine just as petrol is fed from the petrol tank. A special carburettor is placed beside the petrol carburettor.

The two fuels are interchangeable, and either one or the other can be switched on at any time. Bags on private cars will cover from 12 to 20 miles and lorries can do up to 20 miles or more without refilling. Refilling can be done from seven to ten minutes.

The cost of conversion at present varies from £30 for an 8 h.p. car and £40 for a 3-ton lorry.

In running costs there is little difference between petrol and gas. 1¼ to 1½ therms of gas will do the work of 1 gal. of petrol. 11d. per therm will be charged for all gas for motor transport, plus a small filling charge which goes to the garage. The great advantage of gas is the fact that it is unrationed and that vans and cars running on gas can get fuel for all proper requirements.

* * *

Milk Production in War-Time

The Government's campaign for production and economy in the use of food stresses the importance of an ample supply of pure milk as an essential ingredient of a good healthy diet. One of the leading contributions the electrical industry has made to enable dairymen to supply this need, and to obtain the maximum profit from the small margin obtainable in these competitive times, is the provision of electrical sterilising equipment. Especially where replacements or additions become necessary will this apparatus repay outlay, for its well-known benefits of cleanliness, economy and simplicity of operation have, in this case, particularly telling advantages. The demand by users of electrical equipment is likely to be increased not only on account of the ease of operation, which reduces the labour required, but also because the price increases of milk to producers provide an added incentive to bring apparatus up to date.

To meet this demand the General Electric Co., Ltd., is putting forward a complete range of electric sterilising equipment for dairies, and to encourage the use of the most efficient apparatus in war-time the company has issued a new catalogue which is of a very comprehensive nature.

* * *

War-Time Economy of Soap

Any device which effects economy of fats is a valuable one, especially as these are mainly imported into this country for edible and industrial purposes.

Ordinary soaps for hand-washing purposes—and there is a large quantity used annually in industrial establishments — are wasteful by reason of carelessness of use. For instance, they are often left to melt away in the washing water, etc.

The Horton Manufacturing Company, Limited, have devised a method of washing which is extremely economical in use. Instead of between 60 and 80 per cent. fat as in ordinary soap, it requires only 15 per cent., and therefore the Horton Liquid Soap is particularly suited to war-time conditions. This soap is served drop by drop from special dispensers, which ensure that none is wasted—only sufficient is taken to give a rich lather for each user, without contamination, waste or loss by pilferage.

* * *

Colonial Trade

Since the outbreak of war Polak and Schwarz report that they have considerably extended their manufacturing activities. They are also pleased to announce that their export sales are showing a steady increase, particularly in regard to the British Colonies.

They are now considering making certain factory extensions, details of which are not yet available as plans are not sufficiently far advanced.

Arrangements have also been made to manufacture the complete range of Polak and Schwarz specialities in England.

As far as the export trade is concerned, which hitherto has been chiefly organised from Holland, overseas customers, particularly those within the British Empire, are informed that, if circumstances make it impossible for their associated company in Holland to maintain supplies, it is the intention of the English company to organise the export trade from London, in co-operation with their associated companies in Paris and New York.

Until the position in Holland is clarified they invite all overseas customers to send their enquiries and orders to London.

COMPANY NEWS

The Milling Industry and the Government

The Right Hon. Sir Malcolm A. Robertson, Chairman of Spillers, Limited, presiding at the annual general meeting of the company held recently at the Hotel Victoria, Northumberland Avenue, W.C. 2, informed the stockholders that the directors were unable to present the accounts of the company for the financial year ended on January 31, 1940, owing to the imposition of a large measure of Government control on the business of the company and its subsidiary undertakings.

The trading results of the company from the commencement of the financial year to the outbreak of war were wholly satisfactory, but owing to the impossibility of preparing final figures in respect of the period between the outbreak of war and the close of the financial year, it would be necessary to adjourn the meeting *sine die* for the future reception of the accounts. The directors were, however, satisfied that the results for the year as a whole had been sufficiently favourable to enable them to recommend the payment of dividends in respect of the year ended January 31, 1940, at the same rates as those for the previous year.

* * *

The Poppe Rubber and Tyre Company, Ltd.

The Poppe Rubber and Tyre Company inform their customers that they have, for purely family reasons, converted their business into a private limited company bearing the above name.

The managing directors of the company are Mr. F. Poppe and Mr. S. F. Poppe, and, in addition, the following, who have occupied responsible positions in connection with the business, have also been appointed directors, namely: Messrs. R. F. Holden, R. W. Hamlyn, A. H. Manning, and P. Bell.

The conversion of the business into a private limited company will not affect the general conduct of the business, which will be carried on in exactly the same way as heretofore.

Resumption of Examinations

The Royal Sanitary Institute and the Royal Sanitary Institute and Sanitary Inspectors Examination Joint Board announce the resumption of examinations on a restricted scale, particulars of which will be supplied on application to the Institute or the Board at their address at 90, Buckingham Palace Road, Westminster, London, S.W. 1.

INFORMATION AND ADVICE

Steamed Pudding—Orange Juice—Formaldehyde, Continental Mustard and Hydrogen Peroxide—Information Supplied

Steamed Pudding

6,105. *We have contemplated for some time placing upon the market a steamed pudding. Unfortunately, we have been unable to find any suitable recipe either from the reference library or any association, and we are wondering if you can help us in this direction.*

These are sold in varieties of currant, college, ginger, lemon, date, fig, sultana, Christmas, etc. The two main sizes are 5 oz. and 12 oz., sold in pre-war times at 3d. and 6d. respectively.

The flour used must be prepared beforehand by mixing into every 14 lb. 1½ ozs. of bicarbonate of soda. Also mix ½ oz. of soda into 1 gallon of milk. The milk generally used is powdered skim milk, of which 1 lb. is dissolved in 1 gallon of warm water. Dried whole egg is also used. This is soaked in three times its weight of cold water and allowed to stand until it has dissolved ready for use.

The recipe given will make any of the above varieties by substituting the fruit, etc. In the recipe sultana is taken as an example:

18 lb. flour (prepared as described).
11 lb. sugar (soft, brown).
7 lb. syrup or treacle.
12 lb. sultanas.
8 ozs. dried whole egg. } When dissolved,
1½ lb. cold water. } mix lightly.
8 ozs. mixed pudding spice.
2 ozs. salt.
10 lb. shredded suet.
1½ pints milk (prepared).
Egg-yellow liquid colouring.

Method:

Mix well to a stiff dough and weigh out into aluminium basins lined with baking cups made from special paper. Put 5 ozs. into 8-oz. cups to allow for rising. Press a parchment circle on the top of each pudding. Put the puddings into wire trays, cover the entire top with a sheet of parchment paper to keep water from getting into the puddings. Place in stove and close tightly. Turn on steam and cook up to 3 hours at a pressure not exceeding 3 lb. on the pressure gauge. Empty the basins into trays and put at once in heated drying-room. Allow to stand until next day.

When dry, wrap in thin parchment (vegetable—cheap) and then wrap in a fancy-coloured paper, folding the ends on the top and sticking a circular label over to hold down the ends.

This pudding, made according to these directions, will not mould, and can be kept in stock for an indefinite period. They can be boxed in 1-dozen card outers or parcelled for distribution to the retailers. Direction for reheating can be printed on the label. If suet is scarce, compound cooking fat may be substituted, but shredded suet is the best fat for this purpose.

Egg colouring is used in some of the varieties, but caramel is also used instead in some cases.

When puddings are emptied from the basins after cooking they must be placed in drying trays in a single layer upside down. The trays must not stick closely on top of each other, as the steam must have space to escape.

Orange Juice

6,063. *I am greatly interested in the manufacture of orange juice on a commercial basis. Should like to know whether it is necessary, as advised in such books as Cruess's* Commercial Fruit and Vegetable Products, *to add a large amount of sugar and to have costly processes as sterilising and pasteurising, subjecting to a high vacuum for about 15 minutes, and sealing in vacuum for preserving the juice without deterioration of flavour and colour. Or can it be successfully preserved by mere addition of sulphur dioxide ·03 per cent. and rinsing the bottles also in the same preservative? Please suggest a colour which can safely be added without any loss of flavour and taste, and which will not fade in processing and carbonating. Let me know also of any simple process for overcoming loss of flavour.*

I want to start with about 10,000 fruits, giving about 100 to 120 gallons per day. On making enquiries for machinery, I have had replies that the equipment will be necessarily costly, and it would not pay to have such costly machines for so small an output.

We cannot encourage you to believe that there is any simple and inexpensive way of dealing with orange juice. De-aeration is now a universal feature of the citrus-juice industry, and as a result of large-scale tests carried out at Long Ashton Research Station it is evident that air must be removed from the juice if it is to be kept for any length of time. This applies to pure citrus juices and not with products intensively diluted with sugar and water.

There is a plant available working on quite a small scale, down to 25 gallons an hour, which includes a flash pasteuriser (a new type specially designed for fruit juice, and very efficient in its operation) and a de-aerator which works under about 28-in. vacuum.

You ask for a simple process of overcoming loss of flavour. Flavour changes and losses are almost entirely due either to germination or oxidation. Fermentation can be prevented by the use of SO_2. It is not a satisfactory process, despite the fact that 350 p.p.m. of SO_2 are satisfactory for preserving squashes or syrups in which about 35 per cent. of sugar has been incorporated.

The question of plant is extremely difficult in the case of an output of about 100 gallons a day, but the whole question revolves round the problem of flavour. Orange

juices have been processed by omitting de-aeration, but it has been found that after a week the stale, rancid character was already beginning to become apparent, whereas the inclusion of de-aeration in the processing scheme has postponed the development of this flavour for six to twelve months, although it is only fair to say that, however the juice is treated, a slight stale character is generally developed on long-term keeping.

Formaldehyde, Continental Mustard and Hydrogen Peroxide

6,051. *We should like to make some enquiries in connection with our business.*

Formaldehyde. *We understand that it is used in bottle washing, and we would like to hear from you what strength is required, having in mind that the bottles are to be filled with pickled fish in mild acetic acid.*

Continental Mustard. *We would like to have a recipe.*

Hydrogen Peroxide. *Is this allowed, under the food acts, as a bleaching agent for fish and vegetables?*

Formaldehyde: We would say that the use of this in bottle washing is a highly risky proceeding, as there would be trouble should any be left in the bottles, because formaldehyde is a prohibited substance in foodstuffs.

The usual method of bottle washing is with suitable detergents. We suggest you might be interested in an article which appeared in our issue of May, 1939, "The Washing of Glass Containers."

Continental Mustard: The following is a formula you might try:

White distilled vinegar, 40 "grain" ..	500 gal.
Japanese yellow seed	350 lb.
English yellow seed	250 ,,
Turmeric	24 ,,
Cayenne	12 ,,
Salt	165 ,,
Cloves—powdered	8 ,,
Allspice	4 ,,

This recipe will produce 550 gallons of mustard.

Hydrogen Peroxide: The use of this substance is not countenanced.

Information Supplied

6,280. *In your issue of March 15 you gave to an enquirer the address of an English maker of a machine for manufacturing alimentary paste (spaghetti, etc.). As I am also interested in a machine of this kind I shall be obliged if you will give me the address of the maker.*

The names and addresses of the firms were given.

5,639. *In connection with an application which has been made to the Australian Department of Trade and Customs for duty-free entry under Tariff Item 415 (A) (1) of a machine known as a sfumatrice, made in Italy by G. and P. Avena fu Carmelo, Pistunina, Messina, Sicily, some London suppliers of plant have suggested that you may be able to furnish from your records the names and addresses of United Kingdom manufacturers of similar plant.*

A sfumatrice is an automatic machine for the cold expression of lemon oil from lemons. The oil produced by a properly designed sfumatrice has been proved to be equal in quality to the best hand-pressed lemon oil and therefore much superior to distilled lemon oil.

I should therefore be glad to have the names and addresses of United Kingdom manufacturers of such machines in order that the question of manufacture in this country may be investigated. (London.)

The names of manufacturers of this machine were given.

6,296. *I should greatly appreciate it if you could give us any available information regarding the addition of vitamins A, B, etc., to foodstuffs, especially custard powder and gravy powders, etc., and the manner in which these additions are made.*

We learn from your journal that these vitamins are now being added to various foodstuffs, and as we are considering doing something of this nature ourselves, we thought you might be able to help us.

Various firms have been asked to supply full particulars to the enquirer.

6,258. *Can you recommend any firm that makes small power or hand machines for grinding nuts to a paste without expressing the oil thereof?*

Is it possible to obtain pure nut oil which could be used as salad dressings, such as brazil, walnut, hazel and pinekernel, etc.?

Would it be possible to find a firm that would make a household handmill to a definite pattern?

The names of firms able to supply the various requirements were given.

6,267. *Can you inform me of the manufacturers of a hand filler for vinegaring pickles? The type I have in mind is a sort of "Gun" attached to a syphon or pump filler which is inserted in the vat or cask.*

The names and addresses of a number of manufacturers was supplied.

6,394. *Can you please give us the names and addresses of any engineering companies making bread-drying plant, the powder being suitable for mixing with sausage meat?*

Names and addresses of numerous firms were given.

6,343. *We should like to know if you could put us in touch with a manufacturer of gelatine exactly as sample enclosed herewith. This sample was obtained from the Continent about twelve months ago, but we are now unable to obtain supplies.*

The names of firms were given.

6,371. *We are looking for a special type of mixing machine for handling a product of dough-like consistency.*

It is essential, however, that the machine should have a special device at the base for filling the paste into trays passing beneath the machine. It should be possible, moreover, to adjust the machine to deliver any specified amount per tray. The maximum batch would be approximately 1,500 lb. and the amount per tray 18 lb.

Could you put us in touch with manufacturers of this type of machine?

The enquirer was put in touch with a firm who supply exactly the type of plant required.

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RECENT PATENTS

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

Preparing Concentrates of Natural Vitamins

A method of preparing concentrated extracts in which the disadvantages attendant on chemical treatment are obviated. The method consists in treating solutions of the vitamin-containing material with finely divided materials which show a preferential adsorption of the vitamin. The vitamin can then be eluted from the adsorbate with suitable solvents.

In this way concentrates can be obtained by treatment of vitamin solutions with adsorbents without prior chemical treatment. This gives the undoubted advantage of eliminating the danger of destruction or attack of the vitamin attendant on chemical processes.

The treatment with the adsorbent may consist in passing the solution of the vitamin-containing material through a column of the adsorbent, which may for example be aluminium oxide.

By way of example, a method of preparing a concentrate of vitamin E from wheat germ oil is described. The old method of preparing such a concentrate consists in saponifying the oil with caustic soda, when the vitamin is left in the unsaponifiable fraction. There is evidence, however, that the vitamin is affected by this process and that the concentrates so obtained lose their biological effect on keeping. This is eliminated by the adsorption method described below.

Wheat germ oil is dissolved in light petrol (B.pt. 40° to 60° C.) or in trichlorethylene (free from active chlorine and hydrochloric acid) so as to make an approximately 10 per cent. solution. This solution is allowed to percolate (with or without the application of pressure or suction) through a column of suitable adsorbent, preferably activated aluminium oxide of high adsorbent power, and in quantity suitable to the total quantity of oil. Preferably the relative quantity employed is not substantially less than that in the example set out below.

Without allowing the column to run dry, the adsorbent is now washed by the solvent until most of the unadsorbed mechanically retained oil is removed. As much solvent as possible is now quickly drawn through the column by applying a vacuum pump, after which the aluminium oxide is taken out of the container and eluted with a mixture of three-quarters methyl alcohol and one-quarter ether. Other eluters—for example, acetone, ethyl alcohol or dioxan—can be used. This fraction contains a certain amount of saponifiable oil and a very large proportion of the original vitamin E.

The degree of concentration effected by this adsorption depends upon (*a*) concentration of the original solution of oil, (*b*) length and diameter of the column of adsorbent, (*c*) total quantity of oil passed through the column, and possibly other factors, but generally speaking one obtains approximately one-tenth the weight of the original oil held back by the column.

In an actual experiment 150 g. of oil were dissolved in a litre and a half of light petrol, passed through a column of activated aluminium oxide 45 cm. long by 4 cm. in diameter and washed with ½ litre of solvent. The column was sucked dry in two minutes and the oxide eluted by several treatments with 350 ml. of the eluting mixture, 75 per cent. methyl alcohol and 25 per cent. ether. On removing the solvent, 12 g. of colourless oil were obtained, in which practically the whole of the vitamin E of the original wheat germ oil was concentrated.

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Dried Products from Milk and Cream

According to the present invention, a dried milk product containing a substantial quantity of active lactic acid-producing bacteria (*e.g.*, a quantity similar to that present in normal fresh milk) is obtained by adding a culture of lactic acid-producing bacteria in a medium other than milk to skimmed milk, unskimmed milk or cream (or a mixture of any of these) and evaporating the mixture containing the culture to dryness by a spray process. Of course, the bacteria must not all be destroyed in the evaporation (although some of them are sure to be), and the conditions of evaporation must be properly chosen to avoid this, but there is no difficulty here.

In particular, it has been found that very good results are obtained if the culture is one in a nutrient solution such as a solution of sugar in water. Such a solution can easily be sterilised by heating without deleterious results. It should be explained here that if the culture is not added the lactic acid-producing bacteria initially present in the milk or cream are not themselves sufficient to give a product containing enough bacteria, for they do not sufficiently survive pasteurisation or drying or other steps involved in preparing the dried milk product.

By the use of the spray method of evaporation undue destruction of the bacteria is prevented, probably on account of the rapid drying action. In this method, in which the milk or cream is introduced into the drying chamber in a finely divided state and the water evaporates, leaving suspended milk or cream particles, the evaporation can be effected rapidly at a low temperature without any large effect on the solid constituents. The drying chamber into which the milk or cream is sprayed may or may not be subjected to vacuum, and it is of advantage to electrify the milk or cream particles by connecting the spraying apparatus and the walls of the drying chamber to different poles of an electrical source.

Although not necessary, it is preferable to subject the skimmed milk, unskimmed milk or cream to partial evaporation (in normal vacuum apparatus, for instance) before adding the culture. There is then less tendency for the bacteria to be destroyed in the evaporation to dryness.

The bacteria are preferably introduced in the form of a culture in a previously sterilised solution of sugar in water. Such a solution, unlike milk, can be heated to an effective sterilising temperature without deterioration. The sugar is preferably a monosaccharide. An especially satisfactory preparation can be obtained by making a suspension of the bacteria in water, adding a solution of cane sugar, and allowing the mixture to stand at a suitable temperature until the cane sugar is substantially or completely inverted to levulose and dextrose before adding the bacteria-containing medium to the milk or cream (which may, as indicated above, have already been partly evaporated). This invention is preferably effected primarily by the lactic-acid producing bacteria, but if desired suitable acids may be added to assist it. Complex sugars other than cane sugar can be used, and it is here also of advantage to hydrolyse the complex sugars to simple sugars.

A suitable culture for use according to the invention may be obtained by introducing a colony of the bacteria into a solution of nutrients (*e.g.*, sugar) which has been sterilised by heating to a sufficiently high temperature and then cooled to a temperature suitable for propagation of the bacteria.

When the bacteria culture is added to the milk or cream care should be taken that the acidity does not reach the point at which the milk proteins are precipitated, for if this occurred the solubility of the dried product would be impaired. The bacteria and the milk or cream must be thoroughly mixed, and the usual types of homogenising apparatus are suitable for this purpose.

Whether or not sugar is present in the bacteria medium added to the milk or cream, sugar may, if desired, be added at some other stage, preferably before the final evaporation, in order to improve the preservability and other properties of the product. As complex sugars such as cane sugar may make the product too sweet, simple sugars resulting, for instance, from the inversion of cane sugar are preferable.

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